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EAST EUROPE REPORT

SCIENCE & TECHNOLOGY

CONTENTS

INTERNATIONAL INFORMATION SCIENCE CONFERENCES REPORTED

Microprocessor Systems

Warsaw INFORMATYKA in Polish No 7, Jul 84 p 28

[Article: "Conferences On Microprocessor Systems"]

[Text] The sixth international scientific and technical conference of the "Computing Technology '83" series was held from 17 to 19 November 1983 in Plovdiv, Bulgaria. Its theme was "Microprocessor Systems." The conference was organized by the Bulgarian Association of Electronic, Electrical Machinery and Telecommunications Engineers, and the Bulgarian ministries and scientific institutions involved in the development of information science. About 180 specialists, including 30 foreign ones, primarily from the Soviet Union, the GDR, Czechoslovakia, Hungary and Poland, participated in the meeting. The Polish delegation consisted of nine individuals.

The individuals attending the meeting of the Council of Chief Designers of the System for Small EMC [Electronic Digital Computers], which was being held at the same time in Plovdiv and operates within the framework of the International Commission on Cooperation of the Socialist Countries in the Field of ETO [Electronic Computer Equipment], also participated in the opening session and the plenary meeting. The chairman of this council, Professor Naumov (USSR), general designer of the SM EMC [Small Electronic Computer Equipment System], emphasized that microprocessor systems are within the council's scope of activity and presently are one of the most important trends of SM EMC development.

About 130 papers were read at the conference, primarily by Bulgarians, who in many cases described various fragmentary problems concerning the same microprocessor system. Because many authors were absent, only about 60 percent of the economic papers were read. A significant number of papers were read by the representatives of the USSR and GDR. The representatives of Greece, Hungary, Czechoslovakia and Poland presented one paper each. The conference consisted of a plenary session and deliberations in five problem sections.

The following papers were read at the plenary session:

-- "Problems in Developing Microprocessor Application Systems" (Y. Yulzariy and others, Bulgaria), which reviewed 10 types of specialized microcomputers

that will be produced in Bulgaria and are intended for commercial applications, for processing tests and for preparing data;

--"Modern Architecture for Microprocessor Operating Systems" (G. U. Pak, GDR) concerned applications of the Intel 8086 16-bit microprocessor;

--"Using Microprocessors To Design Equipment" (G. Kezling, USSR) described the use of microprocessors in the USSR to control machines, equipment and industrial robots, to test products and to automate measurements, as well as their uses in nuclear power and in design and technical offices as personal computers;

--"Parallel Processing in Multiprocessing Systems" (J. Sukhov, USSR) addressed modern solutions for computer systems serving many parallel computing processes by the use of large numbers of microprocessors. This is especially important for improving the reliability of controlling technological processes.

The papers read in the sections concerned the following microprocessor system problems:

--design organization, structures, elements and methods (section 1);
--data processing algorhythms, calculations, models and techniques (section 2);
--applications (section 3);
--software (section 4);
--texting, diagnostics and reliability (section 5).

This set of problems concerned 8-bit microprocessors (Intel 8080/85, Motorola 6800), 16-bit microprocessors (Intel 8086, Elektronika 60) and even a 32-bit microprocessor (JAPX 432), as well as segmented bipolar microprocessors (AM-2900, Motorola 10800, Intel 3000).

The content of a number of papers from the USSR, the GDR and Bulgaria, especially those papers concerning 16-bit microprocessors and multimicroprocessor systems, gave the impression that these countries are more advanced than Poland in mastering microprocessor technology, especially with regard to theoretical foundations. As already mentioned, many Bulgarian papers concerned different problems (fragments) of the same microprocessor system. These problems were resolved by different groups consisting of several persons, which is proof of the existence in Bulgaria of numerous groups of specialized scientists who are concentrating their interest on selected goals and on well-coordinated research and development work.

Data Transmission Systems

Warsaw INFORMATYKA in Polish No 7, Jul 84 p 29

[Article by Mieczyslaw Bazewicz: "The DDP '83 Conference"]

[Text] The sixth international DDP [Distributed Data Processing] '83 conference, entitled "Data Transmission Systems," was held in Karlovy Vara

from 3 to 6 October 1983. These DDP Conferences have been organized since 1970 by CSVTS [Czechoslovak Association for the Development of Technology] with the participation of interested organs of the state administration and scientific institutions as well as other Czechoslovak associations. These conferences have become an international forum for exchanging experiences and are an excellent illustration of the current status of research and applications in different countries in the field of network technology.

About 400 individuals attended the DDP '83 conference, including 40 foreigners (10 from Poland, 9 from the USSR, 8 from the GDR, 7 from Bulgaria, 5 from Hungary and 1 from Austria). A total of 68 papers were delivered, including 32 from foreigners. The discussions on papers concerning specific themes were conducted as seminars, which greatly facilitated discussions with the authors and exchanges of experiences and views as well as strengthened cooperation among groups from different scientific centers.

In contrast to the previous conferences, problems of an experimental and practical nature were dominant in the contents of the papers. This was an indication of progress in comparison to the contents of previous conferences, at which work of a conceptual nature or model research based on formal methods were dominant. At the same time, the problem of local and public computer networks and standardization trends were discussed much more extensively. The experiences obtained in the building and trial operation of a pilot computer network having communication junctions in Bratislav and Prague were presented in the economic papers. Most of the Polish papers concerned experiences achieved in the course of designing and building the MSK [Interschool Computer Network]. The results of many years of cooperation between Wroclaw Polytechnic and Bratislav's Institute of Applied Cybernetics, the leading centers in both countries in the building of computer networks, were expressed in the contents of the economic papers and in the papers of the Polish specialists.

The specialists from the GDR presented the research results and development goals for the DELTA computer network. The transfer of data and methods for optimizing the use of resources in multiaccess systems and in institutional computer networks that utilize JS [Unified System] computers and minicomputers were the main themes of the papers delivered by the Soviet, Hungarian and Bulgarian specialists.

The numerous and extensive accomplishments of our neighboring countries were brought to light during the course of the conference. The rapid integration of data transmission and processing techniques, and the dominance of data transmission techniques by computer networks and dispersed data base processing systems, were especially evident.

The conference's thematic problem set concentrated on problems of architecture and the efficiency of data transfer and processing systems. The results of the presented research concerned all aspects of this problem, from methods and means to increase efficiency to methods and criteria to evaluate the economic

effects of using computer networks. Thus measurements of efficiency, designing networks, techniques for modeling and simulation, and methods to predict the usefulness of projected networks were discussed.

Deliberations were conducted during the plenary and problems sessions. The themes of the plenary sessions concerned the theoretical bases for evaluating and optimizing the efficiency of data transfer and processing, as well as the experiences and results achieved in designing and implementing computer networks in Czechoslovakia, Poland, Hungary and the USSR. Special attention was paid to the scope, forms and existing cooperation among the groups of specialists involved in the construction of the basic network components as well as in the implementation and operation of pilot networks in the individual countries. The more important experiences achieved during the course of implementing experimental network services in cooperation with the IIASA in Vienna were also discussed.

The themes of the five problem sessions were:

--theoretical problems concerning the measurement and evaluation of efficiency;
--the output and effectiveness of applications of data transfer techniques in computer networks;
--the efficiency of computer networks during design and implementation phases;
--the efficiency of hardware and software, and optimization methods;
--the trends and possibility of new applications in network techniques.

The achievements that were reviewed at the conference served to identify and define the many tasks that to date have not been resolved. Above all, these tasks concern organizational, legal and service tasks with regard to the exchange and processing of information. The new conditions occurring in relations between suppliers and receivers of information network services also are of vital significance. The most important tasks were formulated and assigned in postulate form to the proper Polish and international state and socioprofessional organs. Because of the fact that data transfer technology is determining more and more the expansion of information network services, the conference participants formulated the following proposals:

--the immediacy and future prospects of the DDP conference set of problems, especially its significance for training specialists in computer networks, indicates a need to continue this type of meeting biannually;

--directing cooperation between professional organizations and the higher schools to develop concepts and to standardize definitions concerning measuring techniques and criteria, and the scope for evaluating the efficiency of data transfer and processing systems during their design, construction and operational phases is an urgent task;

--accelerating the production and assuring supplies of equipment within the frameworks of international cooperation that are capable of faster data transmission speeds, for example MDS-type modems, is essential;

--increasing access to network services, especially in the area of gathering and transferring data, the development and production of type series of terminals whose software would permit them to be installed in different types of computer networks, is urgent. The production of such terminals should be economically profitable and their prices should promote computer network applications;

--suppliers of components and constituents of computer networks and transfer systems should be more responsible for the quality of their products and the effectiveness of the services that are specified in the design documents and standards for the systems;

--all institutions and organizations involved in the construction of computer networks should be called upon to combine efforts and resources to develop the legal bases and regulations for communication services with regard to quantity and quality of network services;

--the participation of communication organs should be increased in order to intensify work designed to develop concepts, designs and principles for installing data transfer equipment that meet the accepted standards for constructing and operating universally accessible computer networks.

As usual, the conference organizers published the papers in English and Russian. A method for designing data transmission systems was also published in one of the conference reports.

The significance and role of the DDP conferences, as one of the very few international meetings organized in the socialist countries on the theme of computer networks, should be emphasized. The latest conference is proof of the important changes that are based on increased experience, expanded scope of research work and creative potential as well as the expansion of microcomputer and minicomputer system applications.

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MICROELECTRONICS VIEWED AS SOURCE OF NEW TECHNOLOGICAL REVOLUTION

East Berlin WIRTSCHAFTSWISSENSCHAFT in German Vol 32 No 7, 1984 pp 983-1000

[Article by Werner Huebner, Wolfgang Marschall, Klaus Steinitz: "Microelectronics: Formation of New Type of Technology and Comprehensive Intensification"]

[Text] Microelectronics is now generally judged to be the most important basic innovation of the present and the immediate future. Especially stressed are its extraordinarily widespread impact, its profound influence on the socioeconomic effectiveness of production and of all other phases and areas of the social reproduction process and the high developmental dynamic of microelectronics and its fields of influence.

Despite the short period of development of microelectronics, it now occupies a central position in economic and scientific-strategic considerations of all industrially developed states of the world. Notable are its profound and comprehensive effects which are decisively determined by the character of the production conditions.

Development and application of microelectronics have become an important field of scientific-technical, economic, and intellectual-ideological debate between socialism and capitalism.

In the GDR, microelectronics is used as a main factor of the transition to comprehensive intensively expanded reproduction. In recent years considerable results in the complex development of its significant potential for effectiveness could be achieved in many fields. The fundamental decisions of the Sixth SED Central Committee Plenum in 1977 and the subsequent decisions of party and state leadership for accelerated development and application of microelectronics and the tasks set for the eighties in the economic strategy approved by the Tenth SED Congress now prove to be decisive steps and orientations for the development and constant further development of a broadly defined microelectronics industry and for comprehensive application of its results in the GDR economy. A wide-ranging spectrum of component parts, special technological equipment and subcontractor deliveries for microelectronics, is now being produced by our own effort and based on the developing cooperative relations with the USSR and other CEMA member countries. Constantly new fields of application and microelectronic system solutions are discovered. Thus the GDR economy takes

into account worldwide development trends of scientific-technical progress. "All facts indicate that the rapid development of the productive forces will continue. The manner in which we keep pace in final analysis will determine the economic rank of our country and the standard of living of the people. Pathbreaking processes such as microelectronics...will increasingly penetrate our economy, too."[1]

Many articles have recently appeared in the GDR on economic problems of microelectronics and the development of the modern information and automation technology inseparably connected with it.[2] The following comments are primarily concentrated on some important economic problems and trends of the development of a new type of technology based on microelectronics and modern information technology, especially on the consequences based thereon for comprehensive intensification of the reproduction process.

Microelectronics and New Type of Technology

What is primarily involved here are two fundamental problems of political economy: for one thing, the socioeconomic criteria by which the new type of technology is characterized and the place it occupies in the futher development of the productive forces, of the material-technical base of socialism and thus in the further shaping of the developed socialist society as a whole; on the other hand, the effect of microelectronics on the development of this new type of technology, why microelectronics and its application in the modern information and automation technology occupies such a key position in this process.

The new type of technology is based on the development and comprehensive application of a system of automated working tools, which is reflected especially in a new quality, higher efficiency factor and far greater scope for automation as well as in a higher stage of coordination of all elements of the productive forces, i.e. in a higher technological level of production. The novel information technology based on microelectronics forms the starting point and the core of the new type of technology. It enables technology to penetrate new fields thus far reserved for man, to become adaptable, programmable and thus flexibly usable and to combine the machines into complex integrated systems in which energy, material, and information flows merge into uniform processes.

The new type of technology cannot be solely reduced to information technology. It comprises above all also the relations between information and process technology and in this sense could be characterized as information and automation technology. It is determined especially by its position in the historical process of the further development of the productive forces and of the material-technical foundation and in the implementation of the type of the comprehensive, intensively expanded reproduction corresponding to developed socialism and communism. Its development and comprehensive accomplishment are derived from the dialectical reciprocal relations between the development of the productive strength and the perfecting of the socialist production conditions, especially the intensive socialization of production and labor. Accordingly, there are especially two criteria on which determination of the new type of technology must be based:

1. its role in a new stage of the division of functions between man and machine, for the further development of the productive forces and of the material-technical base as well as for the development of content and character of work;

2. its importance for the unfolding and stable effectiveness of the qualitative growth factors.

New Stage of Division of Functions Between Man and Machine

The past division of functions between man and machine in essence was based on the fact that technology (mechanization and partial automation based on the traditional plant-test, regulation, and control technology) assumed the physical functions of man, especially in the principal production process. The higher stage of division of functions between man and machine is based on the fact that technology (automation based on microelectronics and novel data processing) assumes functions previously reserved for man, especially mental-intellectual operations which have algorithmic processes of information processing as subject matter and a significant part of the operations connected with the handling of workpieces and tools. The significant expansion of the potential field of application of automation to areas of information processing (especially to management, planning, and analysis of the production process, to monetary processes, to achievements of the educational system and of the health system, to the tasks of research, development, project planning and technology preceding production) as well as to assembly and other manipulation processes thus far predominantly performed by man.

The working tools thus acquire a functional expansion through the qualitatively fundamentally new elements of information technology. They now no longer serve the sole purpose of implementing material processes but they also acquire the aptitude to perform immaterial, mental processes and/or to assume the mental components of the work process in material processes, which in the past had been reserved for the direct intervention of man. As a result, they expand the area of employment of the technology and make it possible to automate complicated regulation and control functions which, prior to the use of microelectronics, could be performed only by man.

Microelectronics and its application in modern information and automation technology opens up completely novel possibilities for comprehensive, integrated system solutions of automation and for a clearly more rapid adaptation of automation to changing tasks and requirements of the development of production. Under the influence of microelectronics, an automated, programmable, flexibly usable technology is developing which releases significant economic and social potentials by its possibilities for adaptation to the operating tasks at hand.

The characterization by Marx of the working tool retains its validity in this process: "The working tool is a thing or a complex of things which the worker shoves between himself and the work object and which serve him as a guide to his activity on this object."[3] The work process was and remains complex in nature: it is based on the combination of men, working tools, and work objects. The manner of this combination, however, experiences a fundamental change. The

working tool receives complex, more comprehensive functions. As a result, the position of man in the reproduction process also changes. "It is no longer the worker who shoves a modified natural object as intermediate member between the object and himself, but the natural process which he transforms into an industrial process, he shoves as an intermediate member between himself and the inorganic nature which he takes hold of. He steps next to the production process instead of being its principal agent."[4]

The prediction by Marx concerning the future development of "big industry" now finds its realistic confirmation. The increasingly greater removal of man from the direct production process--in the same manner from various work processes in nonproducing areas--however only constitutes the beginning of qualitatively novel system solutions. It is perfected by creating conditions by means of the performance potential of information technology to simplify process technology and to introduce novel system solutions.

Stronger Effectiveness of the Qualitative Growth Factors

Development of the new information and automation technology plays a decisive role in the unfolding and the greater effectiveness of the qualitative growth factors, especially for more intensive utilization of resources, for a higher degree of refining of the production and, in general, for the development of new effectiveness and productivity potentials and thus for the transition to the comprehensive, intensively expanded reproduction. In our opinion, in connection with the application of modern information technology it is especially justified to speak of the development of a new type of technology also because with it results can be achieved concerning the effectiveness of the reproduction process, which, regarding extent, complexity, diversity and long-term capability for replacement and expansion, are of determining importance for the transition to the comprehensive intensively expanded reproduction. Only the most important directions of effect and connections are to be mentioned here:

1. Pace and extent of the product innovation, increase in the degree of processing of the production and perfecting of the production profile of a significant and further rapidly increasing part not only of electronics but also of scientific equipment building, electrical engineering, and of all machine building are affected.

2. More favorable possibilities arise from the effect as determining influence factor for process innovation in all branches of material production, for rationalization in the nonproducing areas and for higher effectiveness in individual consumption to include all areas and phases of the social reproduction process according to their specifics in the development of effectiveness and the intensively expanded reproduction, to develop and apply key technologies such as biotechnology, material finishing, nuclear technology, and to exploit more effectively the potentials for effectiveness of available technologies.

3. As a result of the special combination of miniaturization, increase in performance, and reduction in costs of the microelectronic elements, the entry

of more efficient integrated circuits, microprocessors, and other elements in information technology and their combination with new working tools and consumer goods, effects can simultaneously be produced for all three production elements as is possible with no other key technology:

--Production increases and savings of human labor by a multiple;

--Significant savings of energy, raw materials, and materials by means of optimum process control, substitution and saving of traditional elements through better energy-economy degrees of effectiveness of the new working tools and consumer goods and especially by greater improvement of the intermediate and final products;

--Higher effectiveness of investments and basic capital, especially by improvement of the price-performance ratio, complex technological solutions, and greater use in terms of time.

Modern information technology constitutes an indispensable prerequisite for more effective use of the potentials of qualitative growth factors such as research and development, education and improving qualifications, management and planning as well as socialist economic integration. On the other hand, the required development of modern information technology is inconceivable without greater effectiveness of these qualitative growth factors.

The development of modern information technology also contains the potentials of a long-term and continuous replacement and reproduction of the effects at an ever higher level. Modern information technology will decisively determine the development of the working tools as the most revolutionary element of the productive forces and the qualitative further development of the entire system of the productive forces over a prolonged period. In the long run, it will lead to the development of qualitatively new aspects of the material-technical basis of society and to the convergence and in some respect also adaptation of the level of the material-technical foundations of the nonproducing area to the material-technical base of production.

The special role played by microelectronics in this connection is based on the fact that, on the one hand, it first creates the conditions that make the functions of modern information technology technically feasible and that, on the other hand, by the radical price reduction of the element functions, it is the indispensable prerequisite for comprehensively applying this information technology in all areas of the economy and in all stages of the reproduction process.

Concerning the Historical Development of Automation

Development of information technology and thus of the conditions for automation is an historical process which causally is not tied to microelectronics. First examples of information technology were mechanical, hydraulic, pneumatic, electrical, electromagnetic and other regulating and control mechanisms, which assumed partial functions of machine control in place of the worker. These "basic units" of information technology were characterized among other things

by the fact that collection, storage, transmission, and processing of information and thus of automation had very narrow limits, that they became effective in relatively rigid systems and predominantly were directly connected with the process technology. Their application required high technical and economic expenditure, which limited their effective use predominantly to automation of assembly-line processes in energy production and to mass production processes, especially in the metal-working industry. Such a basic concept of information technology and automation necessarily had to clash very soon with the developmental requirements of the productive forces. The traditional operating test, regulating, and control technology at first had paved the way to modern synthesis chemistry and production in modern power plants and metallurgical enterprises; this very technology in the sixties had tended to become the hindrance for growing process speeds, increasing throughput quantities, higher quality requirements and for a more rational and complex utilization of energy carriers, raw materials, and materials. On this basis especially no breakthrough in automating production in the metalworking industry could be achieved, 75 percent of which (in relation to the production expenditure) was characterized by individual, small-series and medium-series production. Thus it proved to be increasingly a hindrance for the transition to the comprehensive intensively expanded reproduction.

The technical potentials of the developing microelectronics created conditions for overcoming these hindrances step by step. To an ever increasing extent it is now possible to convert traditional regulating systems to the more efficient microelectronics and to use automatic regulating and control systems also at those spots of the reproduction system in which that had not been possible in the past.[5] The work functions of independent collection, storage, processing, and transmission of information, the work functions most difficult to transfer from man to machine, can now be automatically handled on a broad scale by means of microelectronic system solutions. Microprocessors, highly integrated logic and storage circuits, optical and power electronics elements, sensors, hybrid circuits with specific application-oriented performance parameters are now available in a broad assortment and provide the basis for being able to find an effective automated system solution also in complicated processes.

Information Technology and Development of Working Tools

The historical process of development of the machinery is essentially determined by three factors:

1. the time-consuming process of development and continued further development of the actual process technology;

2. the transfer of more and more new elements of the activity of man in the work process to technical means, whereby initially priority is given to the transfer of physical functions to the technology but, with the higher level of development of the productive forces, increasingly possibilities arise for also transferring mental-intellectual functions to technical means;

3. the gradual development of an information technology which is combined with process technology or makes itself independent and, in a series of processes,

itself becomes process technology. This applies to work processes in which it is not the material and energy transformations or transmissions that are in the foreground but information processing, transmission, and storage, e.g., transmission of communications, computer-based engineering work.

The historical stages of development of the shaping of the modern multi-section machine system are demonstrated by means of Illustration 1. Here

--the step-by-step transfer of increasingly broader functions (direct performance of work, power, regulation) to the technology is evident;

--the trend towards a greater distance of man from the work object becomes clear, a trend that enables him to set more and more work objects in motion by means of a constantly more highly developed technical apparatus and to transform them into improved, high-grade products as a vital condition for raising labor productivity.

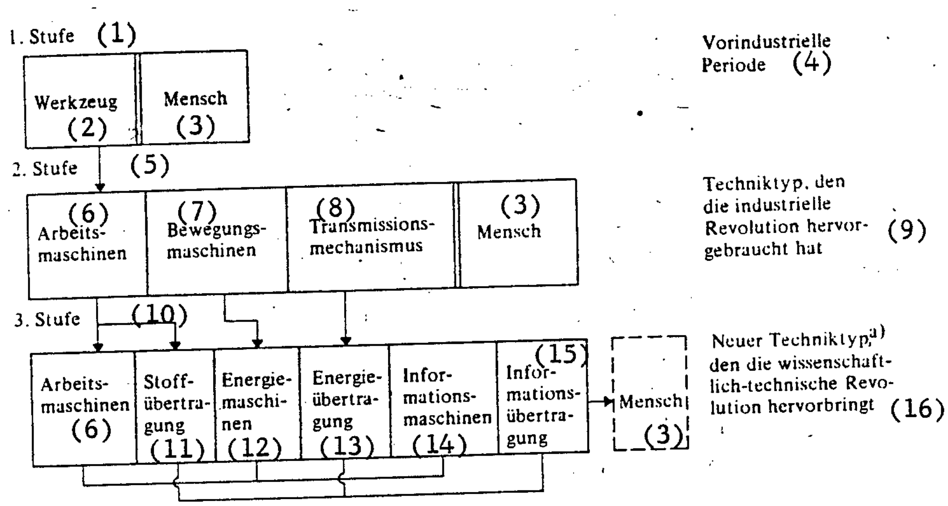
The machinery achieves its thus far highest perfection with the development of the new type of technology as a result of the scientific-technical revolution. In the following, important aspects of the further development of the working tools is to be considered in more detail in connection with the development of modern information technology.

By means of the novel information technology, especially by means of its programmability, the working tools can be considerably better adapted to the specific conditions of application and can flexibly react to changing concrete work tasks. Closely linked therewith, this information technology also causes a qualitatively higher stage in the system character of the working tools. Multi-section, modern machine systems as a rule are based on machines (material processing or "material transforming machines"), energy machines, and information machines as well as material, energy, and information transmission systems.[6] In the case of pure information technology, machine and material transfer are absent. The new working tools based on information technology in their nature thus are broader and more diversified than the multi-section machine system (cf. Illustration 2).

While the right part of the illustration, which is based on process technology and information technology, leads to the four-section machine system and in larger units to complex automated production systems, pure information technology forms decentralized information systems as well as complex information and communications systems (left part). Illustration 2 at the same time makes it evident that information technology is no homogenous technical unit, that it is based on the actual information technology, the hardware, but also on the software and orgware.[7]

The combination of hardware and software characterizes the further development of the working tools based on information technology. As a result, consequences are also involved for the production of such working tools whose technical-economic efficiency is economically fully realized in application and in export and for the constant assurance of optimum utilization of the working tools during their entire economic life. A working tool of information technology or

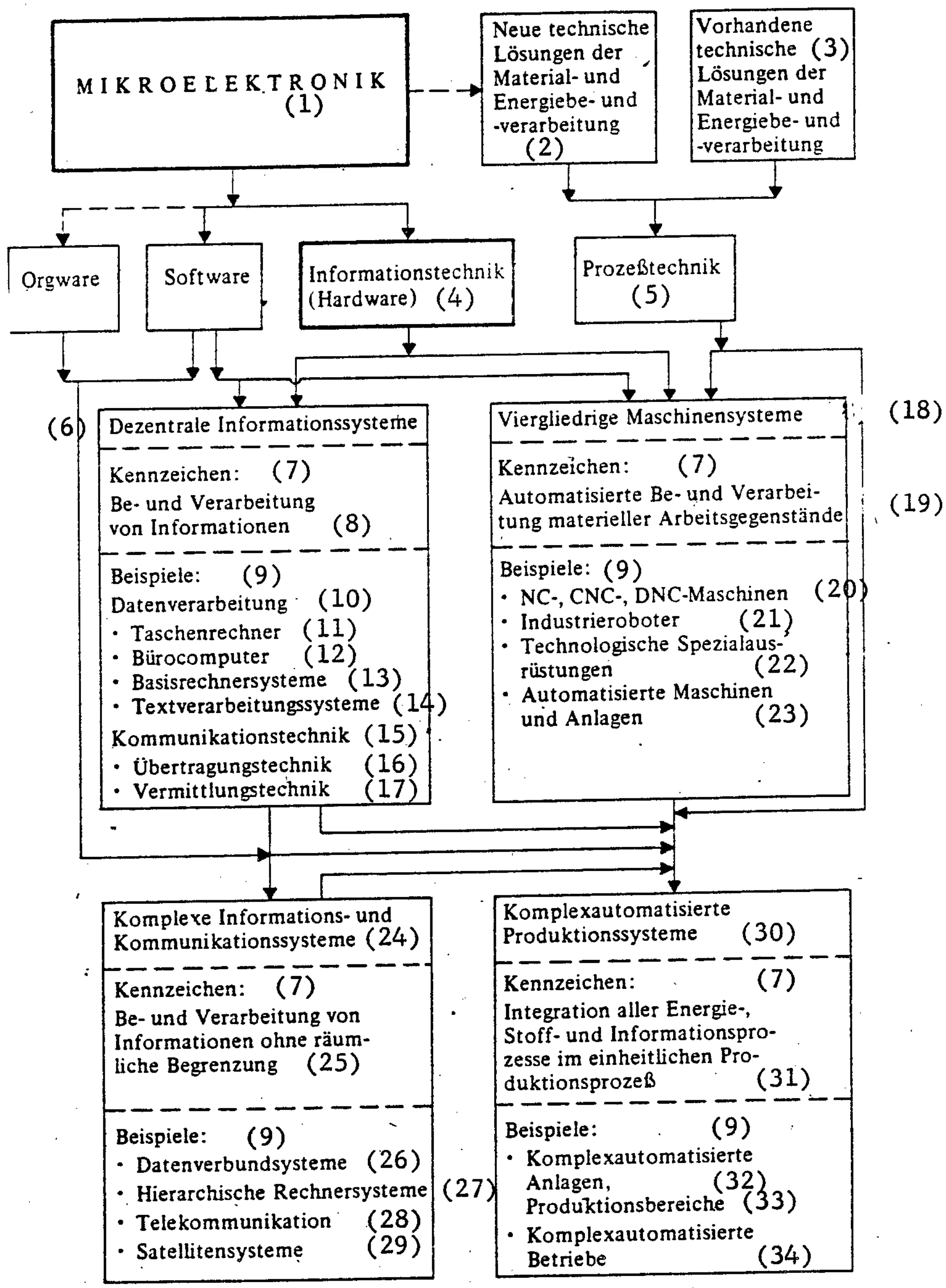
Illustration 1: Historical Process of the Development of the Modern Multi-section Machine System (cf. also H. Nick, "Scientific-technical Revolution ...," op. cit. pp 38, 60)



Key:

1. First stage
2. Tool
3. Man
4. Pre-industrial period
5. Second stage
6. Machines
7. Prime movers
8. Transmission mechanism
9. Type of technology developed by the industrial revolution
10. Third stage
11. Material transfer
12. Energy machines
13. Energy transmission
14. Information machines
15. Information transmission
16. New type of technology (the new type of technology in addition to this form, also comprises pure information handling and processing (cf. Illustration 2) which is being developed by the scientific-technical revolution.

Illustration 2: Elements and Forms of the New Type of Technology



Key:

1. Microelectronics
2. New technical solutions of material and energy handling and processing
3. Available technical solutions of material and energy handling and processing
4. Information technology (hardware)
5. Process technology
6. Decentralized information systems
7. Characteristics
8. Information handling and processing
9. Examples
10. Data processing
11. Pocket calculator
12. Office computer
13. Basic computer systems
14. Text processing systems
15. Communications technology
16. Transmission technology
17. Message switching technology
18. Four-section machine systems
19. Automated handling and processing of material work objects
20. NC, CNC, DNC machines
21. Industrial robots
22. Special technological equipment
23. Automated machines and installations
24. Complex information and communications systems
25. Handling and processing of information without space limitation
26. Data link systems
27. Hierarchical computer systems
28. Telecommunication
29. Satellite systems
30. Complex automated production systems
31. Integration of all energy, material, and information processes in the uniform production process
32. Complex-automated installations
33. Production areas
34. Complex-automated enterprises

a working tool combined with information technology can only be considered together with the material technology. Otherwise, the functioning of the working tool is not ensured or at least greatly reduced.

The most important forms of the working tools of the new type of technology can be characterized as follows:

Firstly: The classical machinery produced by the industrial revolution, which primarily achieves functions of material transformation, together with the transformation of the energy acting on the work object, is linked to information processing functions. Energy, material, and information transforming processes (process technology plus information technology) are combined in a uniform process. The traditional three-section machine system is increasingly replaced by the progressive four-section machine system. In this machine system, process technology is supplemented by a second component, information technology --including software. The scientific-technical level of corresponding machines and equipment thus is determined not only by the process technology but also by the combination of process and information technology. Scientific-technical mastery of only one of the two components necessarily leads to losses of effectiveness in the use of the technology and/or in the sales on the world markets. Even though in the case of working tools meant for materials and energy transformation, process technology also continues to be the determining element and the share of information technology (hardware) in the total value of these working tools differs very greatly (up to 50 percent, but occasionally also below 5 percent), information technology plays a decisive and further increasing role in the development of the working tools:

--The efficiency of the working tools, especially of machine systems, is determined to a high degree by the technical-economic level of information technology.

--Replacement of the production of machines and industrial consumer goods in the near future will have its most important starting point in the development of microelectronics and information technology; the shortening of the economic life cycles and the increase in the annual replacement rates of the products of the processing industry, which takes place worldwide, are attributable especially to the stormy rate of the scientific-technical development of microelectronics and information technology.

--The competitiveness, the export prices to be attained and thus be possible export profitability of machines, installations, equipment, and industrial consumer goods are increasingly determined by the level and the efficiency of microelectronics and information technology.

The development of industrial robotics impressively confirms the effects. First-generation robots now in use, which are merely able to operate according to a preset program, in the future will be replaced by second and third generation robots whose regulating and information-processing part will be based on more efficient microelectronics. They possess so-called self-adaptive systems and are called "robots with artificial intelligence."[8] Second and third-generation robots are distinguished by a broad spectrum of possibilities for use and, according to international estimates, by the year 2000 can be employed at about 30 percent of the jobs in industry with high economic and social effectiveness.

In contrast to that, the technical capabilities of first-generation robots can be used only for about 2 percent of the industrial jobs.[9]

Application of information technology also makes possible perfecting of the traditional process technologies; it leads to further development of the working tools and to a higher degree of utilization of the effectiveness potentials of existing processes and technologies. Development of numercially controlled machines is evident proof of that. At the same time, information technology provides strong impulses to the development and broad application of new technological processes, such as biotechnology, laser technology, fiber optics technology, and thus also leads to the development of new working tools. Linking a microcomputer control with a carbon dioxide laser for example led to a novel inscription facility in the VEB Geraete- und Reglerwerke Teltow which, compared with the customary engraving machines, distinguishes itself by a considerably higher productivity and efficiency. Efficient modern information technology in many cases forms the indispensable prerequisite for the development and application of new technologies and processes in the most varied fields of production and also in the nonproducing area.

The sketched directions of action of information technology in multi-section machine systems achieve especially a higher dynamic and greater variety of the technical development. More quickly than in earlier development periods, they permit adapting the material-technical base to the latest findings of science and technology and thus releasing important potentials of effectiveness. The greater flexibility of the technology also permits more rapid reaction to changing social needs, changed reproduction conditions, and foreign trade conditions.

Secondly: It was possible to develop an independent information processing technology, among other things in the form of computers, peripheral equipment, text processing systems and, in the future, it will expand rapidly in many forms. Its use is possible decentralized as well as also with complex information and communications systems. The use of the decentralized information technology in nonproducing areas and fields of activity by its function and also by its economic weight is perhaps comparable with the use of industrial robots in material processes. It also forms a foundation for the future development of complex information and communications systems. The process will proceed, analogously to that in material production—in the beginning the development of simple elements of the four-section machine system and, building on that, development of complex-automated machine systems. At first, decentralized information technology systems will develop, on the basis of which, and connecting them, complex information systems will develop. A wide expansion of the range of application of working tools in general is linked with the development and further development of this novel technology. Especially in nonproducing areas and areas preceding and following production, many work processes can be mechanized or automated for the first time. In this case information technology itself becomes process technology with high effects of efficiency.

Thirdly: Amalgamation of the two cited groups of working tools--of the four-section machine system and of the relatively independent information processing technology--promotes development of complex automated production systems. Such systems are distinguished by growing integration of varied technological

processes as well as the main and auxiliary processes (transport, storage, transloading, supply, and waste management processes) and the inclusion of before and after areas (design, technology, operational analysis). Development of such complexes is significantly determined by the use and the achieved technical-economic level of the process technology, its combination with information technology and the development of the elements of information technology itself, such as regulating and control technology (NC and CNC technology), computer-supported design and technologist jobs (CAD-CAM systems) data and text processing technology and information technical infrastructure (especially technical base for data transmission and storage).

The complicated development process which leads to complex automated production systems, takes place gradually and is connected with an increase in the plant character of the working tools, which are flexible as regards their utilization potentials and are distinguished by a high level of automation. For example, in the metalworking industry, the transition from the numerically controlled individual machine via NC processing centers, automated production cells to integrated production sectors which will be continued to automated factories.

New Type of Technology--Intensification and Development of Effectiveness

Development and application of modern information technology are closely connected with the transition to comprehensive intensification and increase in effectiveness of the social reproduction process. They lead to a fundamental raising of the technological level of production and thus open up significant possibilities for the increase in effectiveness.

Four essential sides or stages in the chain of effect of information technology--technological changes and--effectiveness and production increase can be stressed:

1. Broad inclusion of information processing processes in complex technological solutions of production and the new quality of automation based thereon;

2. Gradual overcoming of the lagging behind of the technical base in non-producing area, which is possible in principle;

3. The possibilities expanded in principle for the application of new action principles and technologies and processes based thereon, which revolutionize the existing production technology;

4. The more favorable conditions for efficient and complete utilization of the effectiveness potential of existing technologies and processes, including by greater modernization of existing capital equipment.

For example, the productivity gain in the change-over from conventional machine tools may amount to the following:

--NC machines and processing centers, up to 200 percent;

--flexible production systems, up to 300 percent; and

--automatically working production cells for the low-service plant operating up to one full shift as an unmanned operation, up to 500 percent.[10]

Similar rates of increase cannot even be approximately attained without microelectronics and modern information technology by means of perfecting conventional technology--without applying new technologies.

Many examples are known whose results are far above these averages. Even though they only indicate partly the far-reaching results of the effectiveness which are derived, among other things, from reduction of development time, comprehensive and more rapid assessment and utilization of scientific-technical findings, from the simulation and optimizing of certain processes and the closer link with the direct fields of production.

Of special importance to the long-term development of the effectiveness is the new quality provided to automation by microelectronics and information technology. Aside from the mentioned criteria, expansion of the field of application of automation, greater complexity and flexibility of automation solutions, especially by greater reliability and availability of automated working tools, it is characterized by better conditions for mastering the time factor and increased consideration for social and also ecological requirements.

Better mastery of the time factor receives growing importance for the higher new value production and for its economic realization. Automation creates essential conditions for the reduction of preparatory time for product innovation. National and international studies show that, for example, by using computer-supported jobs in technology and design of machine tool building compared to the traditional method of work

--the production time can be reduced by 25 to 80 percent,

--the expenditure of time by 25 to 75 percent;

--the costs by up to 60 percent.[11]

With modern information technology and the new quality of automation, far-reaching consequences also arise for the substitution processes.

On the one hand, the area of application for substitution expands. If past efforts were essentially directed toward replacing human labor as physical labor by objectified labor in the form of working tools and energy, in the future mental work functions will be increasingly replaced by other production factors, especially working tools, including software. An example of the breadth of these substitution processes is the use of computer-supported solutions for design, technology, and production (CAD and CAM systems) which is developing internationally at an extremely high pace. Increased importance is also attained by the substitution of energy and material through information technology, e.g., through optimal cutting of sheet metal or materials and full utilization of permissible minimum dimensions in rolling or by transmission and processing of information, replacing to some extent transportation efforts otherwise necessary and saving the energy and material expenditures required for that purpose.

On the other hand, the substitution processes are qualitatively perfected by not merely replacing one production element by another but by the substitution contributing to a significant total saving and thus to an increase in effectiveness. Decisive for this is the fact that microelectronics and information technology, which are based on the greater use of highly qualified, complicated human labor, contribute to a substitution of resources of a larger quantity by resources with a higher level of service value per resource unit, i.e. so-to-speak of quantity by quality.

These effects of information technology to an essential part are based on the combination of hardware and software in the new working tools. The capacity of the information technology is determined by the scientific-technical level of the hardware as well as also by the availability and development of the software. The software substantially decides how the technical-economic potentials of the hardware are utilized. Thus great importance is to be attributed to its production and its continuous further development and maintenance. It becomes a new, important element of the capital asset economy and of the entire development of the effectiveness. With the greater complexity of the automation solutions, the use of the new type of technology also requires significant changes in the organization of production and of the entire reproduction process and also makes higher demands on management and implementation of the reproduction cycle. Thus development of orgware corresponding to one of these conditions and more effective cooperation between producers and users of the new technology--support of application, training of customers, technical service--are gaining greater importance.

For the long-term development of the effectiveness, it is essential that the information and communications processes, which experience a rapid development in the age of the scientific-technical revolution in breadth and depth[12], and which exercise ever greater influence on the efficiency of the entire reproduction process and on the pace of the scientific-technical progress, can be placed on a machine basis. Availability of the information required for the solution of the scientific-technical and other tasks, its selection and readiness within a very short time increasingly decide now and in the future on the economic effectiveness of science and technology. This will very strongly determine not only the gain in time and the amount of the required expenditures in research and development but also the degree of innovation of the scientific-technical achievement.

The economic effectivity of information and automation technology is also characterized by the fact that its application does not remain limited to the material production but comprises all areas of the social reproduction process. It increasingly penetrates the nonproducing area in which the information processes play the determining role and also affects development and satisfaction of important demand complexes in consumption.

Development and application of information technology, including of the information technical infrastructure, result in the fact that the technical level of work activities in the nonproducing area becomes similar to that of the material production and thus the gap that has historically arisen between material production and nonproducing area in the future can be narrowed in the

development of the effectiveness and in the efficiency of human labor. At the same time, on the basis of the modern information technology, management and planning can far more effectively contribute to the increase in effectiveness of the economic and operational reproduction process by more current information, acceleration of communications processes and raising the qualifications of decision-making processes. Finally from the common features of information processes in the direct production process, in production preparation, in management and planning on the level of the plants, the combines and the economy as well as in the nonproducing areas, there arises the possibility in principle of the development of compatible information technology and the development of complex, comprehensive information systems which rationally link the information processes in the various areas of the reproduction process and of the different levels. Information technology contributes to greater closeness of the reproductive integration of producing and nonproducing areas as well as of consumption.

The effectiveness potential of information technology can only be fully developed and implemented if it is possible to apply it effectively

--on the one hand to complete utilization of the capabilities of the existing technologies and processes, including by the higher level of regulating and control, greater reliability and a far better utilization in terms of time of the machines and plants.

--on the other hand, to the application of in principle new technologies and processes which can only be mastered and implemented by microelectronics and the elimination of certain barriers of the mental-intellectual capacity of man with the aid of the information technology. This includes, e.g., optical fiber technology, which, in the coming years, will find important fields of application in communications, automation technology, computer technology (computer networks) but also in other working tools and in the means of consumption. For the future development of effectiveness, the connection of microelectronics and information technology with the transformation of the process technology on the basis of other key technologies gains increased importance. The greatest long-term reserves of effectiveness probably lie in this field.

The interactions between information technology and process innovation are closely interlaced with the effects of information technology on the socialization of production and the economic structural development, which, in turn, are indispensable conditions for a long-term stable increase in the effectiveness of the entire reproduction process.

Development of the information technology based on microelectronics has very comprehensive and profound social effects. Its effects on the change of the working conditions, on content and character of work, will be far stronger than that of any other key technology. This is above all a result of the fact that it touches on, and significantly determines, the interface in the man-technology relations decisive for the future. According to international estimates, by the end of the eighties about 50 percent of the working people in the most advanced industrial states will come in contact with modern information and communications technologies in their jobs and therefore must possess basic technological

knowledge; about 15 percent will require good knowledge in partial fields in addition to their own specific technical knowledge, and about 4-5 percent will themselves become qualified informatics experts.[13]

Significant possibilities arise from information technology for limiting unhealthy physically hard and monotonous work and for enriching the work contents. But from the production and application of microelectronics, higher requirements also result for training and advanced training of the workers, for their ability and readiness for mobility. Finally, information technology creates manifold conditions for expanding the leisure time and for a meaningful and varied use.

Development of the effectiveness potential of the new type of technology of course is significantly determined by the pace and the extent of its use. Development of the new quality of the technology is possible only gradually for technical, but especially for economic reasons. Based on the generally achieved level of development of the productive forces and of the socialist production conditions, the technology depends especially on the level of the scientific-technical achievements, on the available investment potential and its use for for scientific-technical innovation processes, on the pace and the level of the structural changes, and on the development of the socialist economic integration.

Of special importance to the development of the new type of technology is the use of the possibilities for modernization of the available capital assets with information technology means. The special feature of information technology, in contrast to the development of the working tools during the industrial revolution, consists in the fact that at first it is combined with the existing process technology or the existing machine system, i.e. it can be largely integrated into the existing material-technical base.[14]

Without limiting the manifold technical-economic conditions for rationalization of the existing capital assets, it is possible to start from the assumption that in the long run modernization of capital assets is especially effective if the technical perfecting of the existing machines and equipment proceeds in a manner so that it leads to a higher level of automation of the production, in other words if a new, automated, programmable, flexibly usable technology develops. Within the next few years this is especially the case where it is possible to change over three-section machine systems into four-section machine systems or a qualitatively higher development of the information technology in already used four-section machine systems. The latter is especially of importance in the modernization of existing installations in assembly-line processes, including those of energy production, metallurgy, the chemical industry and in the achievement of further development stages for the automation of complex production processes. The use of modern information technologies based on microelectronics makes it possible to utilize the existing process technology much more effectively, which, in turn, contributes to saving of human labor, raw materials, and energy and contributes to a reduction of environmental pollution.

Also processes that make possible a broad development of potentials for effectiveness by fundamental redesign of the technological regime can be key factors

of investment-saving rationalization. Included here are, among other things, the present predominantly discontinuous production processes of the metalworking industry. Examples in this connection are "integrated, object-specific production sectors" for the production of component parts in small and medium numbers, which make possible the transition from discontinuous to continuous production. A multiplicity of such production sectors were developed and effectively applied in production in GDR machine building in past years. This includes integrated production sectors for the handling of dynamically balanced and prismatic parts in enterprises of the following combines: Umformtechnik "Herbert Warnke," Erfurt; Schwermaschinenbau "Karl Liebknecht," Magdeburg; and "7. Oktober," Berlin. Such complex and flexible production combines the use of existing conventional machines and equipment with process-flexible industrial robots, CNC machine tools and computers for regulating the work-piece and tool transport. Depending on the achieved level of automation, especially of the work-piece and tool transport and of storage, an increase in labor productivity to 140-200 percent and a reduction of processing time by 40-60 percent could be achieved in the integrated production already attained. At the same time, utilization of the production area increased 20-40 percent.[15] For the volume of the necessary investments it is important that, in the case of integrated production, replacement of still existing conventional technology and new technology can be carried out partially and gradually.

The investment-saving modernization is directed especially at the existing capital assets. Novel machines and equipment influenced by modern information technology, e.g., numerically controlled processing centers, process-flexible industrial robots, and other machines and equipment as well as the manifold forms of decentralized and complex information and communications systems (cf. Illustration 2) must at first become gradually a component of the material-technical base by new investments.

Considerable expenditures for software development and maintenance may become necessary also in the case of modernization of existing machines and equipment on the basis of the modern information technology just as in the case of new investments. In this connection it should be noted that process-specific software must be developed to a greater extent also by the user. As a result of that, there is a new area of responsibility for the building by the combines of rationalization means, an area of responsibility whose importance will greatly increase in the next few years.

Possibilities and ways for the introduction of information and automation technology are varied. They must be assessed in a sophisticated manner as regards their contribution to the intensively expanded reproduction. In this connection, strategies for a gradual development of adaptable sections for complex solutions are gaining in importance. Thus it is also possible to use the existing buildings and capital assets and to better master the complicated economic, organizational, and social problems arising from the remodeling and or new designing of production processes.

FOOTNOTES

1. Seventh SED Central Committee Plenum, E. Honecker, "At a Time Filled With Struggle We Are Continuing the Tested Course of the Tenth Party Congress for Peace and Socialism," Dietz Verlag, Berlin 1983, p 29

2. In this regard, cf. among others: H. Koziolek, "Science, Technology, and Reproduction," Verlag Die Wirtschaft, Berlin 1981; H. Nick, Scientific-technical Revolution, Historical Place--Stages of Development--Social Nature," Akademie-Verlag, Berlin 1983; H. Nick, "Information, Information Technology--a Special Element of the Productive Forces," WIRTSCHAFTSWISSENSCHAFT, No. 3, 1984; I. Fischer/ K. Hartmann, "Industrial Robots in Socialism," Dietz-Verlag, Berlin 1983; G. Langendorf/H. Nick, "Trends of the Qualitative Change of the Working Tools," WIRTSCHAFTSWISSENSCHAFT, No. 1, 1983; H.-D. Haustein/H. Maier, "Flexible Automation--Core Process of the Revolutionary Change of the Working Tools in the Eighties and Nineties," WIRTSCHAFTSWISSENSCHAFT, No. 5, 1982; W. Marschall, "Utilization of the Effectiveness Potential of Scientific-technical Progress in the Intensively Expanded Reproduction," WIRTSCHAFTSWISSENSCHAFT, No. 9, 1982; H. Nick/K. Steinitz, "Scientific-technical Revolution, Microelectronics, and Intensification of the Social Reproduction Process," WIRTSCHAFTSWISSENSCHAFT, No. 11, 1982; P. Straehmel, "Concerning Some Problems of the Determination and Development of the Effectiveness Potential of Microelectronics," WIRTSCHAFTSWISSENSCHAFT, No. 8, 1983; J. Dubrau/W. Netzschwitz, "Microelectronics, How it Changes Our Life," Dietz-Verlag, Berlin 1983; E. Paessler, "Present and Future of Industrial Robotics," in "Thinking Ahead to the Future," ("In die Zukunft gedacht"), Verlag Die Wirtschaft, Berlin 1983.

3. K. Marx/F. Engels, "Works" Dietz Verlag, Berlin 1956-1968, Vol 23, p 194

4. K. Marx, "Outline of the Critique of the Political Economy," Dietz Verlag, Berlin 1974, p 592.

5. Cf. U. Gruehn, "Development of the Material-technical foundations of Information Processing--an Important Task in Perfecting the Material-technical Base of Socialism," WIRTSCHAFTSWISSENSCHAFT, No. 2, 1982, p 202.

6. The literature generally speaks of the four-section machine system. In accordance with Marx, the processing machine, the prime mover, the transmission mechanism and the newly added information machine are regarded as its elements. It would be quite justified to designate such a system as a "six-section machine system." The third stage in Illustration 1 makes this clear. In the interest of uniformity in the references, nevertheless there are only references to the four-section machine system in the following. Four-section machine system is also somewhat imprecise because information technology is not simply

added as the fourth section but in part also is integrated directly into the existing elements, for example in the processing machine or the prime mover.

7. Cf. in this connection E. Richter, "Concerning Utilization of the Software for Raising the Capacity of the GDR Economy," WIRTSCHAFTSWISSENSCHAFT, No. 3, 1984; W. Marschall, "Utilization of the Effectiveness Potential...," op. cit., p 1307 ff.

8. Cf. I. Fischer/K. Hartmann, "Industrial Robots in Socialism," op. cit. p 86.

9. Cf. E. Paessler, "Present and Future of Industrial Robotics," op. cit. p 201.

10. Cf. R. Georgi, "High Degree of Automation Is the Future," TECHNISCHE GEMEINSCHAFT, No. 5, 1982.

11. Cf. G. Kesseler/W. Eckhardt/W. Hickmann/D. Kochan, "Development and Use of Automated Jobs for Design, Technology, and Project Planning," Lecture 33 of the IKM 82, Leipzig, p 8.

12. In the natural science field alone, there appear now about 4 million articles in technical periodicals, 300,000 new or newly edited books, 400,000 patent specifications, one million dissertations and research reports. This amount of information is doubled every 3-4 years (cf. A. Jugel, "Higher Effectiveness of Man-Machine Communication by Using Equipment of the Languages and Printout,"Lecture, ERAM 83, Leipzig).

13. W. Scharlowski, "Communication Is More Than Information," FRANKFURTER ALLGEMEINE ZEITUNG of 20 Oct 83.

14. Cf. H. Nick/K. Steinitz, "Scientific-technical Revolution...," op. cit., p 1627.

15. Cf. W. Uhlmann/H. Buschbeck/I. Kleeberg/K. Rudolf/I. Voigt, "Mechanization and Automation of Component Production by Means of Integrated Production Sectors," Lecture 20, IKM 1982, Leipzig, p 20.

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DEMANDS OF INFORMATION TECHNOLOGY ON EDUCATION, SOCIETY REVIEWED

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[Article by Prof Dr Harry Nick, Institute for Political Economy of Socialism, CC SED Academy of Social Sciences: "Scientific-technical Progress: Nature and Contents of Work--Requirements for Education and Training"]

[Text] The most pervasive changes in the living conditions of men that socialism has brought about mainly occurred in the sphere of its most important activity in life, in labor. Here it became most clearly evident, and perceivable for individuals, how a society freed from exploitation offers man all chances for developing his creative capacities. Perfecting all conditions for highly productive labor that would at the same time powerfully promote the all-round development of socialist personalities and collective relations has always been the centerpiece of the working class party's policy. "The SED proceeds from the consideration that work is the most important sphere of public life. It commits itself to the all-round development of the socialist character of labor. Working conditions must be shaped, according to plan, in such a way that they will nurture pleasure in work, dedication and creativeness and the working people's striving for order, safety and discipline."* The socialist production relations and political power relations determine the basic socioeconomic features of socialist labor as work freed from exploitation and expended according to plan. At the same time experience shows that the increasing development of the characteristics inherent in the socialist nature of work--notably the reciprocally fructifying factors and conditions for increasing labor productivity and its personality-forming effect--is ever more affected, throughout the maturation process of socialist society, by scientific-technical progress. The effect of scientific-technical progress on shaping the socialist nature of work comes mainly through the modification of the qualitative condition of concrete labor functions, of the contents of work.

Qualitative Modification of the Contents of Work

The perceptible advances we have made in recent years in shaping progressive contents and conditions of work are essentially due to that we increasingly turned from revising technical and organizational solutions ex post facto to

*"Programm der Sozialistischen Einheitspartei Deutschlands," Dietz publishing house, Berlin, 1976, pp 23 f.

dealing with it prognostically, by projections. This also shows that assigning unequivocal and demanding economic as well as social targets is indispensable for opening up the economic and social potentials of the scientific-technical revolution in ways and means that conform with socialism. This amounts to saying that the scientific-technical progress has to be used deliberately to reduce heavy physical and monotonous work, enrich work with intellectual-creative elements and increasingly facilitate a harmonious combination between physical and mental work. This becomes increasingly important for better satisfying men's intellectual-cultural and material needs and for the social rapprochement among classes and strata.

Scientific-technical progress can exercise these functions only in close connection with modifications in the division of labor. Technical solutions first determine the totality of labor functions man has to cope with. How these labor functions are "distributed" among the various working people is of an importance to the nature of the conditions and contents of work that is relatively autonomous. This precisely explains that identical technical systems may have most diverse consequences for the qualitative nature of work contents. While under capitalist conditions one pursues the tendency of distributing activities, e.g., above and beyond the technologically "justified degree," so that an increasing polarization of work activities is the result--more and more workers requiring above-average qualifications compared to technicians, on the one side, and a still more rapidly increasing proportion of semiskilled and unskilled, on the other--socialist conditions deliberately seek opportunities for an increasing complexity in labor tasks, seek to combine various labor operations (operation, maintenance, repair, production preparation).

In its long-term and overlapping tendencies scientific-technical progress broadens the opportunities for improving the contents and conditions of work. This becomes most apparent in complex automation solutions that make the relations between men and working tools looser and more elastic, so that elbow room is gained for porposefully shaping progressive work contents. Of course, even this is not free of contradictions. There is no simple analogy between a progressive technization of labor, the transition to higher levels of technization, on the one side, and improvements in the contents of labor, on the other. For instance, in automated production processes entirely new problems and difficulties arise: there are the risks that work contacts may diminish and that people might not be very busy, and other things that are absent under the conditions of mechanized production. Demands made on a job may become more contradictory so that, e.g., high demands are made on the sense of responsibility and on education and qualifications, on the one hand, yet one-sided psychological stress on nerves or even physical excess burdens cannot always be avoided (such examples show up in the production of microelectronic components).

Among these contradictions also is the expanding range between technization levels. On the one hand, manual work will still play a very big role in the foreseeable future; circa 32 percent of industrial workers is not working with machines today. Yet on the other hand, mainly in connection with the development of microelectronics and robot techniques, automation is going to make further headway.

Finally one must watch out for contradictions in the educational and qualificaiton level, as to its being actually available and actually being needed for the work. In the outcome of our successful educational policy, the working people's educational and qualification levels have risen fast in the last decade. It has not always been possible to the proper extent also to modify the material working conditions under which this greater educational and qualification potential could actually take effect. This high and further increasing educational and qualification level is among the most important and positive lead achievements in our society also with regard to coping with the scientific-technical revolution successfully. These lead achievements, comparable to investments, economically speaking, must time and time again, with a great sense of purpose, be transformed into economic gain. At the same time it is surely also important to prepare young people while they still are in school, for not finding everything fully in place when they start their jobs that is necessary for them to be able to apply their knowledge and skills, for having to play a part themselves in making the necessary modifications, for placing their honestly doing their duties above everything in any case, even where working conditions and work contents conform neither to their subjective ideas nor to the targets and criteria of socialist work.

About the Role of Data Processing

Data processing undoubtedly has the strongest and most permanent effects in the scientific-technical revolution on changing the contents of work.

To me, it is the key process in the scientific-technical revolution.* The type of technology produced by the industrial revolution (circa 1760 to 1830) mainly brought to realization the functions of energy and material conversion. It freed the energy volumes usable in the production process from the limitations of man's physical labor capacity and thus caused the transition from the type of reproduction predominant in the capitalist modes of production--simple reproduction--to extended reproduction. The scientific-technical revolution today causes fundamental changes in all objective elements of the productive forces (working tools, working materials, technological procedures and energy sources). The most important here is--if one understands technical progress primarily as a progressive process of transferring human functions to technical means--that this technization also permits intellectual activities, i.e. functions in gaining, transmitting, storing and processing data. This technology overcomes certain limitations of man's intellectual labor capacity (speed and precision in performing logical operations and the like).

Data processing--within only a few decades--causes an explosive expansion, as it were, of the field of application for technology as such. Since both functions of human work--physical and mental work--are technifiable, there are hardly any important fields of activity left in which important work functions could not be technified; the fields of untechnifiable activities is shrinking. This comes together with the fact that because of data processing many fields of activity now only become technifiable for the first time.

*Cf. H. Nick, "Information, Information Technology--A Special Element of the Productive Forces," WIRTSCHAFTSWISSENSCHAFT, No 3, 1984.

And that is indeed absolutely necessary, if one wants to keep the chance for efficiency improvements from being reversed. In line with its basic function in energy and material conversion, one finds classical machinery primarily in areas where the object of labor is directly modified, in so-called treatment processes. Such processes still are in many industrial enterprises enclaves within modern technology to some extent enclosed by labor that is not or is only slighty technified, in final assembly processes as well as in susidiary processes (transportation, transshipment, storage and maintenance processes), in preparatory processes like R&D, design and technical preparation and also in the management and planning processes. The fact that circa one third of the production workers in the centrally managed state-owned GDR industry are not working on machines is likely to be due largely to scientific-technical progress in the past having been linked fairly closely to treatment and processing processes. With the type of technology we have had thus far it would hardly be possible to adapt most labor activities in industry (including the preparatory and the management and planning processes) to the use of the technology.

As data processing functions have to be dealt with in nearly all fields of human activity, the gradual introduction of data processing will introduce scientific-technical progress in many areas that were virtually closed to it thus far. The economic and social effects of this technology will in the non-producing and service sectors, hardly touched by technical progress in the past, undoubtedly be felt as much as in the production sectors.

The increasing range of information technology means that dealing with it becomes an important part of general education and training, that it does not remain restricted to the circle of specialists in electronic data processing--concentrated in the combines and enterprises in organizational and computer centers. "Distributed data processing" is becoming ever more widespread, which becomes both more centralized in parts and then again also more decentralized. Jobs with terminals and screens in dialogue operation are being used more widely. That brings to all of engineering but also to the labor functions of specialists essential qualitative modifications. From there important changes result in the conditions and contents of labor. Among the most important tendencies are probably the following:

Man gets more and more opportunities to affect the outcome of labor, which is more and more directly governed by the technological-economic parameters of the hardware and the quality of the software. This tendency of objectivating the labor results comes together with a greater role played by the subjective factor (more mediation in an effect must not be understood as being less effective). On the one hand, man has a greater chance to influence the functioning of technical systems. That is due to the flexible use of programs, a greater chance for combining sub-programs through flexible automation, and the dialogue operation with ADP hardware. On the other hand, technological discipline, strictly abiding by technological instructions, becomes more important.

Through the automation process the quality of programs is gaining increasing importance for the outcome of the work. This is a new type of effect the subjective factor exercises on production and labor processes. Microelectronics, on the one hand, brings about centralized data processing and information systems

and, on the other hand, increasingly decentralized data processing. This broadens the chances for intellectual-creative work.

Scientific-technical progress with its generally overlapping tendency produces increasing opportunities for enriching work with intellectual-creative elements. The relations between man and the working tools become increasingly elastic, human activity and the functioning of the machinery can be separated in space and time, and the concrete work attitude is less controlled from the outside and becomes more subject to rules. Inner motivation for work becomes more important to the same degree. The tendency to subdivide work operations is more and more turned over to the machine, and human labor operations are more brought together and are becoming more complex. The subdivision of labor operations loses its economic potency in many areas also in the narrower sense.

Higher Demands Made on Creative Activities

The demands made on creative activity undoubtedly will grow. There are two essential points here:

1. Creative activity for different people relates of course to specific interests and concrete working tasks, but it always takes the whole personality. Not only through his knowledge and technical skillls and facilities is a man a productive force, but that he is with all his abilities and traits, his value concepts, interests and personal modes of behavior. Precisely in these terms it matters to train and shape personalities in all directions: in their basic ideological and political positions, their technical knowledge and skill, their capacity for experience and pleasure, and their depth of feeling.

2. What the precise meaning of a creative attitude is, can and probably should be further debated. But one thing seems unarguable to me: It mainly is an active attitude toward one's environment, a sociopolitical commitment, a search for more efficient solutions, the readiness to adopt thus far unknown and unused new approaches, and developing and cultivating one's own intellectual-cultural interests. The most important thing here may well be curiosity and pleasure in tinkering with things, strongly induced by moral and material recognition.

Training in the prerequisites and capabilities for a creative attitude is so complicated because they are inherently contradictory and cannot be clothed in simplistic, one-dimensional conclusions for educational work. That includes, e.g.:

Imagination and Realism

The persistent rate of high speed in scientific-technical progress, above all, calls for an extraordinary degree of imagination, both where it is produced and where it is applied--and the wide range of application is one of the most striking features of the qualitative transformations the scientific-technical revolution induces--calls for leaving habitual tracks and for the ability to anticipate intellectually what in reality still has to be created. Modern technical transformations emit enormous fascination; so they give wings to our imagination. But exactly that reason they may also nourish illusions and unrealistic expectations. Not so rarely one underestimates how great the efforts are that are required as well as how expensive preparing the use of robots, microelectronics, complex automation solutions, for example, in fact is. Training in economic

thought undoubtedly is one of the most important prerequisites for lending wings to our imagination without losing sight of the real givens. This becomes all the more important as the multiplicity in technical and technological solutions for fabricating identical or very similar products is increasing, the problem of rank and sequence in the use of modern technology (e.g. of office computers) gains in importance because of the multiplicity of its applications, hard to keep control of, and, finally, its economic effect depends not only on the parameters of the equipment, but increasingly also on the programs and the types of systems for such technical solutions. All this means that the economic effects of scientific-technical progress have to be organized much more systematically and puposefully. Experience tells us that modern technologies make economic effects possible which, otherwise, through traditional techniques, would not be attainable at all. That experience tells us also, however, that when one uses modern expensive technology losses may also be incurred in magnitudes that are hardly possible when working with traditional technology.

Mental Flexibility and Mental Discipline

Creating and cultivating an atmosphere in which creativeness prospers, curiosity is stimulated, the joy in one's own discoveries is enhanced by explicit recognition--all that is more than ever among the desirable goals not only in the schools, but in practical economic management activity as well, in all sectors of public life, in fact.

As experience teaches, this can be done most effectively and permanently only through simultaneously instilling mental discipline, purpose and tenacity in pursuing tasks assigned, with great rigor--and some degree of severity--in making high demands and in rating the achievements performed. Without great diligence and without straining mental and physical capacities at times way above the average, above-average achievements are generally not feasible; they are achievements of the intellect as much as of one's character.

All this becomes evident in connection with the struggle for scientific-technical progress. On the one hand, that asks for checking all possible variables for technical modifications without prejudice, taking new approaches and new risks. On the other hand, we need more assurance for making inventions and discoveries in predetermined directions, at given moments and with definitive economic minimum results. That our economic and social progress depends more now on scientific-technical progress enhances, as it were, the social liability of scientific-technical work and calls for more imagination and more discipline alike.

Innovator Work and the Sense of Tradition

To do away with old ways that no longer work and to adapt as fast and early as possible to new developments, to take new approaches with energy, is an indispensable criterion for scientific-technical innovator work. It would however be completely wrong to draw the inference from this that the elements of stability and continuity now had become less valuable. The very opposite is true, and this precisely because scientific-technical progress is accelerating. Technical innovations do not come about the same way in all sectors and not all in the same tempo. Precisely because, e.g., product substitution generally accelerates for

finished products (machines) and machine varieties are increasing, standardizing components and component groups, reducing variety there, and a very low speed in modifications there--always with the proviso, of course, that this would not impede technical progress for end products--are increasingly becoming economic advantages. The faster scientific-technical progress moves, the more important it becomes to modernize existing plants instead of simply exchanging them for new models and to preserve and improve what one has.

Especially under the conditions of a speed-up in scientific-technical progress it is important to take care of production traditions carefully, and that includes the technical traditions. Experience teaches, e.g., that certain skills and abilities handed on from generation to generation that cannot be conveyed completely through the study of theory are of extraordinary value and maintain that value. If such traditions are broken, it can take a long time to close that gap again. Therefore one should always cautiously examine which skills and abilities are in fact devaluated through technical change, are supplemented or substituted for by other skills and abilities. These handy generalizations on that the scientific-technical revolution reduced the importance of manual skills (the crafts to some extent), e.g., and that they are replaced by larger theoretical knowledge, are all too vague. Precisely in sectors experiencing an extraordinarily high rate of speed in scientific-technical progress, the "golden hands" of the specialists also are of extraordinary importance. What has in fact changed is that production experiences and technical traditions stay alive today and in the future mainly by being combined with new knowledge and new experiences.

5885
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COMPETITION DEVELOPS IN PRODUCTION OF PERSONAL COMPUTERS

Budapest MUSZAKI ELET in Hungarian 13 Sep 84 p 9

[Text] Sixty types of personal computers are being sold in Hungary today. According to estimates 25-30 of these are of domestic manufacture. This also means that competition is developing--slowly but gradually. Competitive PC's are available in fair quantities.

Sixteen manufacturers are producing professional computers which can be offered at a price above 350,000 forints, but seeing the gigantic demand for smaller performance personal computers a number of enterprises are experimenting with their manufacture. The MTA-SZTAKI [Computer Technology and Automation Research Institute of the Hungarian Academy of Sciences] and the New Life Producer Cooperative in Sarisap began manufacture this year of a computer called PRIMO, suitable for various technical calculations and for preparing financial records. They expect to sell 6,000 of them by the end of the year for less than 10,000 forints. The product of VIDEOTON has more serious capacity but fewer applications programs; it has been named the Z80/A after the microprocessor. Its manufacture also began this year, its price is 16,000 forints, and they plan to sell 1,000-1,500 by the end of the year. The Signal Technology Cooperative is also offering two personal computers; they will manufacture 2,000 of the HT-2080/Z and 1,000 of the PTA-4000 models this year. The price of the former will be 42,000 forints and of the latter 40,000 forints. The LABSYS professional computer of the Labor Instrument Industry Works is a good bit more expensive than those mentioned; its manufacture began last year but even this year they are undertaking to make only 200 of them. Its price is 270,000 forints. The Syster professional computer of MTA-SZTAKI is 10,000 forints more expensive and they plan to manufacture between 200 and 300 of them this year.

Of the more expensive, higher performance professional computers it is worth mentioning the systems of the Computer Technology Coordination Institute and its subsidiary enterprises; they will manufacture almost 1,500 of them but twice as many might be sold. The M08X and two personal computers of the Proper family are sold together with applications programs and services are provided to customers in a manual combined with a sales catalog in a form which is updated monthly. The more significant of these are the Firmware developmental system and the Teledata leadership information system. Repair of equipment and systems is provided by their own service unit, in cooperation with Volan Electronics, within 24 hours in the capital and within 72 hours in the provinces.

The gigantic demand is prompting domestic computer manufacturers to step up production, increase the performance of their equipment, reduce prices with innovations and by all other means, develop their service networks and take care of parts supply. Since the number of models is very, very large, repairing and maintaining the domestic computer pack in use requires serious preparation.

8984
CSO: 2502/2

RESULTS OF DO-IT-YOURSELF COMPUTER ASSEMBLING KITS

Budapest MUSZAKI ELET in Hungarian 13 Sep 84 p 9

[Text] As the press has reported the first domestic computer building camp was organized this summer in Szolnok. The campers, of various ages and occupations, received from the county culture and youth center, for 10,000 forints, full board and lodging and a computer parts kit. After mastering the BASIC language and programming they assembled a HOMELAB-III microcomputer which they could take home after the camp. Their employers undertook to pay for many of them, primarily so that they could teach computer technology in the smaller or larger settlements with the aid of a finished machine and the knowledge acquired.

The initiative aroused the interest of very many people, for no guidance is available for the absolute beginners, there are few professional clubs outside of schools, and there are hardly any computers accessible to them. But the morale of the organizers was at a nadir before the camp opened because the popular culture workers had only suspected up to then but did not know how difficult it was to get materials. They had to obtain parts, not just any kind but keyboards and printed circuit sheets and integrated circuits. The fact that the computers could be completed by the time the camp ended is thanks primarily to Elektromodul, the Gamma Works and eight other enterprises which aided the pioneer undertaking simply for love of the cause.

(If the factories assemble the computers themselves their profit is substantially greater than when handing on their products as parts. For example, the price of a school computer is 40,000 forints; that of a computer assembled from the parts kit is 7,500 forints, without screen and tape recorder.) Radio amateurs also joined in the acquisition of materials, telling around the country what important parts were missing. Help also came from Zagyvarekas and so--although making the programming information more profound must be done at home--every HOMELAB was brought to life during the camp.

The experiment succeeded--they assembled computers from the first Hungarian kits. Now it only remains to create enterprise interest in selling their products as parts.

Since then 50 of the participants in the Szolnok camp have been teaching smaller or larger groups of acquaintances back home either officially or semiofficially, telling them for what and how the little machines built by them can be used.

8984
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LITTLE PROGRESS SEEN IN ELECTRONICS PROGRAM IMPLEMENTATION

Budapest MAGYAR HIRLAP in Hungarian 2 Oct 84 p 7

[Article by Kristof G. Kocsis: "A Difficult Start; Conference on Electronics Parts Manufacture, Historic Responsibility"]

[Text] Siofok was the scene of a 3-day conference last week. About 400 experts debated the situation and timely problems of electronic parts manufacture. We summarize below the main thoughts of the speakers.

As an experiment in a completely automated textile factory in Japan they left about 200 looms on their own Friday afternoon. The sensitive equipment stops immediately if it senses a material fault or a break in the thread. On Monday, when the experiment was evaluted, 85-90 percent of the machines were rattling along happily. Dr Laszlo Kapolyi, minister of industry, cited this example at the seminar last week surveying the situation of the electronics industry.

The event can offer us many kinds of lessons. On the one hand, it is very probable that here the machines would have all stopped on Friday. The supply of primary material, the measuring instruments and the level of automation of light industry are still far from the success of such an experiment. But the story is also suitable as an illustration of how the rational use of electronics does not put jobs in danger but rather can replace people doing work under difficult or unpleasant circumstances. Another thing to add to all this is that in the GDR they have already worked out a government program for the automation of night shifts.

Parallel Advantages?

After many postponements, a central program for the development of domestic electronics, the EKFP, was born at the end of 1981, which prescribed about 3 billion forints for investment. Of this, 1.8 billion was to lay the foundations for domestic microelectronics parts manufacture. The investments started under very difficult circumstances, so in essence everything is proceeding on schedule only at the Microelectronics Enterprise, with the production of integrated circuits. But the majority of the enterprises participating in the EKFP which manufacture non-microelectronic parts are lagging 1 to 1.5 years behind the developmental pace established in the program--for lack of needed funds.

Naturally everyone agrees that developed instrument and equipment manufacture cannot be imagined without a parts background at the world level. At most there can be a debate only about where the necessary parts come from. Today, domestic sources cover about 40 percent of the needs of equipment manufacturers. But in recent years--including the period after working out the EKFP--this ratio has been decreasing. For example, it was still 65 percent in 1975 but even in 1980 it reached 50-52 percent. Unfortunately, the near future does not promise to be much better. In his talk Deputy Minister Zoltan Koteles noted that even in 1985 domestic industry will manufacture about 20 percent fewer parts than prescribed in the EKFP.

No need to ring the alarm--we might say--what domestic industry does not deliver can be made up from import. At most in theory--the device designer says--because as a result of the narrow foreign exchange possibilities only the most necessary parts, not available elsewhere, should be acquired from the capitalist market. But for the most part it is just these special items which lead the COCOM lists. At other times the Western firms will not deliver some special circuit for business policy reasons. If they sell them only built into their own products they can preserve their monopoly situation.

A closer source still remains; even today 18 percent of the parts needed for domestic electronic equipment come from the socialist countries. Although the European CEMA countries, without exception, have sacrificed more than we have on account of their electronic background industry, still they could undertake only selective developments and began to develop phantom thin slices of the big cake of electronic parts manufacture. And for the most part they are all offering the same thing. In a fortunate case this parallelism could become a source of advantages, they could divide up products within individual technological processes. In the case of so-called equipment oriented circuits, for example, it is a marketing advantage if there is a second manufacturer so that in case of need the same part can be acquired elsehwere.

Equipment designers also blame the socialist import circuits for the fact that they are not exchangeable with similar Western types in every case. And since they cannot be simply exchanged for them the device must be redesigned, which increases the costs of the manufacturer. In general they do not provide developed use recommendations for these IC's either. And sometimes the circuits figuring in the catalog are not even being manufactured when the brochure comes out.

Blaming One Another

So all things considered, the equipment manufacturers are not in an enviable situation. A swifter development of the domestic electronic parts industry is an ever more urgent task. All the more so, because a few of the parts--the experts listed them during the break between talks: linking elements, transformer plates, ferrites, knobs to improve the esthetics of the devices or primary material for printed circuit sheets--could be produced within our borders without any special investment or technical development. But still, all this must be obtained from capitalist import in more than one case. But if they came from domestic plants then, on the one hand, the narrow financial

resources could be turned to more profitable parts and, on the other hand, industry would get a valuable commodity base for exchange.

But for the time being--as was shown at the plenary session--the domestic manufacturers are blaming others. Those producing equipment consider the domestic parts too expensive, and they are offered for a good bit more than the world market price. And the parts manufacturers complain because their profit, proportional to receipts, does not reach even 40 percent of that of their colleagues manufacturing finished products.

It is also said that the regulators today pass judgment according to excessively segregated enterprise results; nor is it too fortunate if a manufacturer of primary material is encouraged exclusively to direct export. The profit at the level of the national economy is a good bit less in this case than if we exported our most important capital, our intellectual energies, in the form of instruments and electronic equipment. Relatively little material is coupled with the investment of much intellectual work in electronic equipment.

Condition: The Money

Electronics will receive special emphasis in the course of realization of the next 5-year plan. Three chief tasks stand before the experts. First, they must develop manufacturing technologies which make possible more economical use of materials and energy. It is becoming a commonplace that domestic plants use specifically 20-30 percent more material than in the developed industrial countries. It appears that not much more can be cut from this waste by organizational measures alone, so there is an urgent need for modernization of manufacturing and testing methods. Second, the technology serving the production of electronic parts must be developed at a fast pace also. Finally, the third task is the development of biotechnologies.

There is a close link among these goals. The development of microelectronic technology, for example, will make possible the production of complicated, precise instruments and these, among other things, will encourage the manufacture of integrated circuits. Or consider the link between biotechnology and electronics; according to the scientists by the end of the century biochips, a revolution of technologies copying the human brain can be expected.

The output of the domestic electronics industry--we could hear at the seminar--will grow in the future according to the plans in a way far exceeding the average for industry, by about 11 percent per year, so that in 1990 we can expect to double the 1985 production value. But in the conversations of enterprise leaders overheard in the corridors the concept voiced most frequently as a precondition for everything was money. In the course of working out the Seventh Five Year Plan the electronics industry got the maximum within the possibilities. And, as Dr Laszlo Kapolyi said: "A historic responsibility falls on that generation which provides developmental possibilities greater than the average in an economy in a difficult situation."

8984
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SCIENCE, NATIONAL DEFENSE CONNECTION EXPOUNDED

Warsaw NAUKA POLSKA in Polish No 2, Feb 84 pp 35-57

[Article: "Science and National Defense"]

[Text] A scientific session, organized by the PAN [Polish Academy of Sciences] and the MON [Ministry of National Defense], was held on 26 October 1983 to mark the 40th anniversary of the LWP [Polish People's Army].

Published below are:

--The speeches delivered at the completion of the deliberations by Service-Branch General Florian Siwicki, minister of national defense, and Zdzislaw Kaczmarek, PAN fellow and PAN scientific secretary;

--The speeches by the chairmen of the four sections in which the deliberations occurred: Section I, "Armed Action During the Most Recent History of Poland," Prof Dr Kazimierz Sobczak, director of the Institute of Military History; Section II, "The Sociopolitical Role of the Military in the Life of the Country and Nation," Prof Dr Janusz Letowski, deputy director of the PAN Institute of Legal Sciences; Section III, "Science and Technological Progress and the Defense of the Country (in the Area of the Exact and Engineering Sciences)," Div Gen Wieslaw Wojciechowski, chief of the MON Military Technology Research and Development; and Section IV, "Science and Technological Progress and the Defense of the Country (in the Area of the Biomedical and Food Sciences)," Miroslaw Mossakowski, PAN associate member and secretary of the PAN Department of Medical Sciences;

--Reviews of the reports of the session deliberations.

Florian Siwicki

The scientific session of the PAN and the MON, whose fruitful deliberations are coming to an end, is an important scientific event in the celebrations of the 40th anniversary of the founding of the LWP. Its systematic, problem-orientated nature enhances its special standing. It is a good indication of the level and results of cooperation among civilian and military scientists and of its practical uses.

Today's deliberations, which are a significant expression of this cooperation, have produced much valuable material. In accordance with the session's assumptions, we have been enlightened in science more fully in many areas concerning the LWP and Polish society. The deliberation expanded to an important extent our knowledge, in a scientific sense, about armed actions in earlier times but mostly in the latest history of Poland, about the people's army and its unbreakable bonds with society, and about the sociopolitical role of the army in the life of the nation and the socialist state.

The session also provided us with further evidence confirming the growing influence of science and technological progress on developing and strengthening the country and its defense, documenting the bonds and interdependences that are occurring in this regard. New possibilities have arisen in this field. The session also produced many important facts and interesting scientific generalizations in the areas of history, politics, sociology and the technical and biomedical sciences that are of value in the continuing efforts to improve the country's current defense.

This became possible above all because of the efforts of scientists who are represented in this hall, especially the representatives of its highest forum--the PAN. We value very highly this lively interest and the active well-disposed attitudes of scientists toward defense problems. We are well aware that science serves this defense more and more fully and with increasing effectiveness. We also believe that it reflects the deep understanding of Polish scientists for the need to strengthen the country's defense capabilities in the wide meaning of this concept.

This is being expressed by the increasing number of representatives of Polish science who are involved in the defense problem. It is being manifested by combining specialized scientific work with defense-oriented research. Above all, it is proof of almost 25 years of fruitful scientific cooperation between the PAN and the MON. The sense and worth of this cooperation, however, applies not only to the activities during this period. It is especially characterized by the systematically expanded problem scope. It augments the increasingly significant social, economic and defense results. In the past several years, this cooperation has reached a new, higher quality. Mutual scientific working contacts are now common in almost all the basic activities of the social, technical and natural sciences. It is our intention and desire to expand and strengthen further this cooperation.

In these times in which we live, almost all areas of human life and activity are based on scientific foundations. This also applies to the armed forces and to defense.

Under present conditions, the struggle for superiority on the probable future battlefield begins in the laboratories and design offices. Many achievements of science and technology--and very varied ones at that--are applied more rapidly in modern systems of armaments and offensive weapons. But science, which exerts a decisive influence on the development of basic factors of the state's defense forces, is in itself one of these factors.

In this sense, considering the known facts in the area of modern armaments, scientific activity is a specific form of struggle. In resolving somewhat the first encounter with a potential enemy, science paves the way for further defense activity.

This specific form of confrontation of scientific potentials also imposes certain requirements on Polish science. Above all, it expands its participation in the processes for improving and strengthening the country's armed forces and defense. This is exactly as it should be and is an important requirement of our times.

Cooperation among civilian and military scientists meets this need. Its scope is wide. It encompasses various aspects of the country's defense. It extends to all areas: moral, ideological and political, psychological and organizational, praxiological, technical and biomedical. In each of these areas, which were discussed in the material presented at the session, scientists create numerous mechanisms designed to strengthen the country's defense potential.

The main calling of science is to serve man and to act creatively to develop the country peacefully. In this regard, the socialist political system provides many opportunities for science. However, the present international situation is marked by an increasing threat to the peaceful development of mankind and is mainly the fault of American imperialism. Unfortunately, this is the reality. "The present situation is difficult and even dangerous," said General of the Army Wojciech Jaruzelski, first secretary of the PZPR Central Committee. "The present Washington administration is building a war state. The intention and attempts to unbalance the balance of power on a global scale are obvious, and the intention to overturn historical changes is obvious. The plans and even the first steps taken to install new American missiles in Western Europe are especially provocative."

We are most vitally interested in maintaining the peace. It is a matter of utmost importance, the goal of our manifold efforts, including our efforts in the scientific field. After all, it is impossible to counteract the forces striving for war without the active participation of science and all the scientific communities.

The growing activity of our cooperation is an expression of this role of science and the necessity of its active participation in creating permanent, antiwar barriers and in effectively stopping the military ambitions of imperialism.

This matter is also well served by the letter of 30 September 1983 from the Presidium of the PAN appealing to scientists all over the world to counteract actively those forces that strive for regional wars and confrontation on a global scale by not controlling the arms race.

The increasing threat from the imperialist states, including our experiences over the past 3 years concerning the destructive effect on our country, requires that the defense of People's Poland be strengthened

consistently in all areas: ideological-moral, political, economic, technical and military. It is a task of state importance and of a comprehensive, interdisciplinary nature. It can be accomplished successfully only with the active, meaningful participation of science, with the close cooperation of the country's many scientific centers and communities.

The complexity of the tasks in the system to improve the country's defense that was shaped in a coalition system, and especially the high level of technology of modern arms systems, also require that scientific cooperation with the other socialist countries be intensified. The partner-like multilateral collaboration with Soviet science plays an especially important role. It is a vital factor, an important element in strengthening our defense coalition.

However, primary attention is being concentrated on our own Polish science. There are many examples, which will not be named here, proving that valuable and important results are being achieved, from the viewpoint of the country's defense, in the scientific laboratories of designers and scientists having various specialties, in PAN's research centers and in the research centers of the individual ministries and university facilities. The application of these results can produce and are producing measurable benefits in this regard.

Along with this it should be emphasized that defense can also be strengthened by adapting to its needs--as much as possible--the results of work that serve the socioeconomic development of the country. This applies to the social and biomedical sciences as well as to the technical and other sciences. Also, these results can be increased many times by improving the linkage of the current and multiyear scientific research plans of the country's individual scientific and economic plants and structures with current and future defense requirements. We will strive for this to the greatest extent possible.

Experience indicates that the links existing between science and the country's economy and the MON's economic activity are to a great extent mutually related. This also was emphasized during today's deliberations. It indicates many facts and considerations, including the army's participation in shaping the country's science policy. It was indicated that many developments of military scientists are being applied in the national economy--in radar, communications and medicine. The reciprocal advantages resulting from joint research and application activities of civilian and military scientific institutions that are involved with broad research problems in the technical, biomedical and other fields was also emphasized.

This capability is due to the socialist nature of our army, its modernity and its large scientific-research base. The LWP encompasses in its ranks an intellectual potential that is meaningful on a national scale. Our army is distinguished by its high degree of technization, and developed electronic and computer systems. It has extensive scientific-didactic and scientific-research facilities, including 5 higher academic-type schools, 11 higher officer schools, many institutes and other scientific institutions.

Our army's level of development, the universality of training for our professional cadres, who have achieved many important scientific accomplishments in many fields, and the creative ambitions resulting therefrom indicate that we are ready to accept and to apply effectively the scientific developments and solutions of the highest scientific parameters.

The military scientific research potential, conspicuously supported by the capabilities of the civilian scientific community, is developing and modernizing the armed forces, strengthening the nation's defense with good results. At the same time, in accordance with the nature of our army, we also are applying these capabilities to Polish science and to the socioeconomic development of the country.

Investing in defense and in the armed forces, in addition to its primary defense goal, also bears fruit in civic upbringing and professional training, in modernizing various areas of our economy, in applying scientific and technical accomplishments in more and more applications, which increases the wealth of our country and influences the development of our country.

The session's material strongly accented the important role of the army in Poland's historical process. Also indicated was the vital, state-creating role of the Polish Army in the history of our country and its exceptionally important activity--from the viewpoint of defense and independence--in the process of shaping national consciousness and patriotic attitudes in Polish society. In addition, it was clearly emphasized that the Polish people's armed forces played a vital role in our struggle for liberation during World War II and in forming the framework of our socialist statehood. Considering the latest happenings in People's Poland, however, the status and obligations of the socialist army in the life of the nation and society, its internal function and the tasks flowing from it, were expressed most clearly of all.

The class nature and political calling of the socialist army gave rise to its close contacts with society and service to the nation. The best proof of this is the 40-year history of our army. It is expressed in its struggle for the country's liberation, its coparticipation in creating the organs of a people's government, and the rebuilding and expansion of the economy. The army's active participation in defending the threatened security of the nation and the socialist state is an eloquent example of this.

This problem was reflected in the session's material. Much attention was devoted especially to the participation of the LWP in overcoming the sociopolitical crisis during the 1980-1983 period. During this period, especially under martial law, the army found itself at many important posts. The professional cadres were especially active in fulfilling police functions, in returning the operation of the administration and economy to normal, in assuring public peace and citizen safety. Being able to handle this exceptionally responsible and complex task also is proof of our army's versatility, its modernity and working-class nature.

The army's obligations during the current stage were also considered during the session. We share the view that the army can and should help to overcome the threats that are still occurring and to help resolve socioeconomic and political-upbringing problems. Among other things, the army's active participation in popularizing and realizing the resolutions of the 13th Plenum of the PZPR Central Committee can also serve this purpose well.

The army plays an important role in patriotic-civic and defense education, in forming the ideological-political consciousness and personalities of young people, especially that portion performing their basic army service. We are trying to do this as best as possible. The past few years have shown that these are tasks that are socially important beyond measure and are exceptionally far-reaching politically.

This extensive participation of the army in all the primary areas of the country's and nation's life, which was presented fully in the session's material, is to a certain extent a new phenomenon in the history of the LWP. Thus, it requires comprehensive analyses and research, including joint research by historians, sociologists and political scientists from the MON and the PAN.

In addition, I believe that the desired results of cooperation can also be augmented by properly directing research. I especially have in mind directing the attention of various groups to those problems and directions of scientific cooperation that would allow research goals to be combined. In this way, by minimizing outlays, it will be possible to achieve results that are useful for the country's socioeconomic development as well as for shaping its defense capabilities.

Concentrating research efforts in selected directions and on selected problems most certainly requires designated improvements in the existing system of cooperation between the PAN and the MON. We believe that all we want to accomplish jointly in science should be planned in detail. We also believe that in all cases our partner-like scientific cooperation should begin at the scientific-concept stage and continue until the achieved results are actually implemented and jointly evaluated. We believe that we should also strive to improve further the system of scientific cooperation between the PAN and the MON before the Third Congress of Polish Science, that is, during the time in which all schemes for directing Polish science are systemized, in order to adapt this cooperation to its new tasks and requirements.

In closing our deliberations, I wish in the name of the organizers of the session to thank Comrade Prof Henryk Jablonski, the chairman of the Council of State, for his participation. In my own name and in the name of MON's directors, I thank the president and members of the PAN Presidium, the PAN scientific secretary and the PAN Scientific Secretariat and all the PAN and MON institutions for their efforts in preparing and conducting the session. I especially thank the scientists who prepared and delivered the papers and who appeared at the sessions of the individual sections.

I also wish to thank the representatives of the High Council of the United Armed Forces of the Warsaw Pact nations for their participation. I also wish to thank the military attaches of our allies and our honored guests for their presence at the sessions.

Zdzislaw Kaczmarek, PAN Fellow

The scientific session organized to mark the 40th anniversary of the founding of the LWP is a very important event. It occurs at a time when tensions in international relations have increased to their highest level since World War II. The plans to deploy the Cruise and Pershing II missiles in Western Europe have appalled the people.

The socialist states face a new arms race that was imposed on them. This poses new tasks for the scientific community. The duty of scientists is to identify themselves with the political justifications of their own country and to serve the need of their own nation. This civic duty is a moral injunction, especially now when there are difficulties and when in the past several years Poland has experienced these difficulties, which were exacerbated by the aggressive attitudes of the imperialistic centers.

In our history there are many examples of patriotic posture by scientists. Here I would like to mention Prof Sylwester Kalinski, a member of our PAN who died prematurely, who was a general and professor, a distinguished scholar and soldier who served the fatherland and the nation.

Since the first units of the LWP were called up, much has changed in the world. The concepts of war and the defense of the country as well as the scope of the functions executed by the armed forces have changed. New forms of danger have arisen that are known simply as ideological, psychological and economic warfare. The functions performed by the army and the relations between society and its armed forces have changed significantly.

The specific function of the LWP during the socioeconomic crisis and the martial law period was reflected in the material of today's session. In addition to its permanent external function, the LWP assumed the difficult tasks of ensuring peace security for the citizen, and helped the national economy and administration to return to normal.

The session showed the significant links between the ability to defend the country and the development of science and technology. The ability to defend the country depends to a great extent on the technical equipment of the armed forces and the application of scientific discoveries. But it should be remembered that the future of our entire economy and Poland's status in the socialist camp and in the world also depend on scientific-technological progress. Here the vital needs and tasks of the country's defense and the peacetime economy converge, especially since the numerous technical solutions that are useful for the armed forces also find numerous applications in industry, satisfying the day-to-day needs of society.

The ability to defend the country also depends on intellectual superiority over the enemy. Thus the role of scientific research increases in those areas that not too long ago were not in the army's sphere of interests. To an increasing extent the country's defense is determined by the scientific, political and ideological level of the entire society.

The 13th Plenum of the PZPR Central Committee emphasized the significance of ideology in social life. In this respect, the role of the social sciences, which provide scientific arguments for the ideological struggle, is of special importance. There is no need to justify how important this front is at this time in view of the increased propaganda campaign aimed directly against Poland by the capitalist countries. Thus, expanding cooperation between PAN's social science institutions and the MON will increase the potential aimed at shaping people's attitudes not only in the armed forces but, above all, in all of society, and the idea of national rebirth will be promoted.

The cooperation between the MON and the PAN, which was evaluated positively during the session, encompasses joint research projects conducted by PAN and MON institutions that are important from the viewpoint of defense and that are based on the needs of the national economy. Applying the results of this research improves the qualifications of the scientific cadres and increases the exchange of scientific ideas and information.

Military institutions are participating in resolving complex and interministerial problems that are coordinated by PAN institutions; conversely, PAN institutions take part in resolving problems introduced by military institutions. The good results achieved as a result of this cooperation are based on organizational discipline and a good attitude toward the conducted theme, among other things.

PAN's scientific committees are an important link in this cooperation. Representatives of military scientific institutions and of the individual services participate directly in the work of scientific committees as committee members or as members of working groups evaluating results and making recommendations concerning the country's socioeconomic development and the tasks of scientific and technological progress. Numerous groups of military scientists participate in the prognostic work and expertise provided by PAN's scientific committees. They distinguish themselves by their high level of science and good orientation to the country's overall socioeconomic problems. Representatives of the army systematically attend scientific seminars and conferences organized by the PAN and participate in the preparation of publications presenting research results.

The cooperation of the scientific councils of PAN and MON institutions and of the Interministerial Commission for Evaluating Basic Research is also very important. In participating in the work of these groups, representatives of the army can present the country's defense needs, influence the shape of research programs and evaluate the achieved results from the defense point of view.

The cooperation between PAN's institutions and MON's didactic and scientific-research institutions in the realm of training and improving the scientific and technical cadres is very important. PAN's scientists teach at the higher military schools and scientific institutes that are subordinate to the MON.

MON employees are accepted by the PAN for doctoral studies and can qualify for assistant professorships at PAN institutions. The large number of MON employees enrolled in courses in applied mathematics conducted by PAN's Institute of Mathematics is an example of opportunities created by PAN institutions.

The contacts and exchanges of experiences in the realm of improving and using research laboratories are very important. Becoming acquainted with research methods and scientific equipment is especially important, considering the increasing shortages in scientific institutions. Many specific examples of the results of cooperation were mentioned in the papers and discussions, which make it unnecessary to discuss them any further.

As indicated in the session's materials, PAN-MON cooperation encompasses all scientific groups and practically all scientific disciplines. This is warranted by the country's current and future needs.

The good results achieved in the framework of this cooperation were made possible by the improvements made in this cooperation over many years, by the personal participation of Comrade General of the Army Wojciech Jaruzelski and Comrade Service-Branch General Florian Siwicki, whom I would like to thank sincerely on the occasion of today's session.

A word of recognition and thanks from this tribunal is also due to the officers of the MON Delegation to the PAN Presidium, who are operating under the direction of Comrade Brig Gen Rudolf Dzipanow. They contributed much to the work of scientific cooperation and to the work of sociopolitical stabilization in the PAN during the martial law period. Thanks to their efforts, consistency in work and tact, many difficult PAN problems were resolved.

I would like especially to thank our esteemed foreign guests for their participation in the session. Thanks also to the representatives of the High Command of the United Armed Forces of the Warsaw Pact nations: Comrade General of the Army A. F. Shcheglov and Comrade Lt Gen W. G. Serebryakov.

The socialist countries have great scientific and technical potential. About one-third of the world's scholars are employed by the institutes, laboratories and schools of these countries. Combining the efforts of all the socialist countries in the field of science and technology will certainly produce positive results, satisfy economic needs and improve the defense potential of our socialist camp.

Kazimierz Sobczak

The first section, which is involved in defining the status and role of armed action in Poland's most recent history, referred in its deliberations to the first papers delivered during the plenary session.

About 100 people participated in the section's work. All scientific communities, civilian as well as military, were represented and were involved with the described problem.

A total of 9 participants spoke and over 20 pronouncements were included in the official record.

The set of problems for Section I that was designated in the program of deliberations is very important for researching the latest history of our nation. The speakers emphasized the special role of armed action as a component of the latest history of the Polish nation. After all, the postwar period, which now exceeds 38 years, forms an essential perspective that permits events to be explained with great scientific accuracy, events that contributed to the loss of independence in 1939, to the formation of a people's state and to a modern defense.

Representations of the various scientific centers presented the results of their conducted research on Poland's armed actions and the traditions of Polish weaponry. Prof Dr Hab Andrzej Nadolski referred to ancient history, extracting the continuity of the tradition of Polish weaponry. In his interesting talk, Prof Janusz Tazbir discussed the research postulates concerning the influence of military traditions in shaping national consciousness. Prof Col Marian Leczyk presented his view of the role of armed action in restoring Poland's western border after World Wars I and II. Referring to the entire 1,000-year history of the struggles of the Polish nation for a permanent and secure western border, he emphasized that these struggles are related to the push eastward of aggressive German forces. He also emphasized the fact that the return of political orientation to the west, the linkage to the so-called Piast concepts, is always associated with the existing threat to the Polish state from the west.

Most attention was devoted to the role of armed action during the 1939-1945 period and during the War to Liberate the Polish Nation. During the session's deliberations, Col Doc Dr Hab Mieczyslaw Wieczorek discussed the military problems of the revolutionary worker movement during World War II. Retired Brig Gen Dr Franczizsek Skibinski spoke about the role of Poland's armored forces during World War II. General Skibinski, who was a participant in that war, spoke of his personal experiences and theoretical problems.

Cdr Rafael Witkowski's speech contained extensive historical material of great scientific-cognitive value. He presented a complete picture of Poland's naval activities on the oceans and seas during World War II. In material included in the official record, he described the activities of the air force and other types of services, presenting the latest research in these areas.

Col Prof Emil Jadziak spoke about the problem related to the rise and development of Polish socialist military ideas. This is an entirely new problem that has been considered to date only in publications on military history, but not in the scientific literature. Much work remains to be done, including the history up to modern times. The reviews are very favorable, and it is hoped that they will be disseminated rapidly among military and civilian readers.

Poland's armed actions are well documented in the literature, film and art. This documentation was described during the section's deliberations by Doc Dr Stefan Treugutt, Doc Dr Bohdan Jaczewski and Dr Stanislaw Ozimek.

In a way, the talk by Col Prof Dr Hab J. Kaczmarek was a summary of the section's deliberations. He linked the historical experiences with our country's current defense policy and our current defense doctrine.

Even though the section's deliberations did not last too long (it should be stated bluntly that they were too short), they were useful and valuable. They formed a base for an exchange of views by the military and civilian representatives of the scientific centers concerning the historical and current role of the army in the life of the nation.

The plenary deliberations were especially useful during our section's discussions; they provided many new supplementary elements and new ideas that deserve full attention. It also provided an opportunity to present the works of scientists in the area of research on the substantial armed action during the most recent period, showing the genesis of the armed forces, their dynamic development and their participation in the Great War of Liberation of the Polish Nation against Nazism, and in the area of military and training-upbringing experiences. Thanks to the deliberations, we obtained a complete picture of the role of armed action during the last 200 years, and even further back in time, based on the latest research. The speakers mentioned the role of armed action in all the crucial moments of the nation's life, emphasizing that they have always been a significant and at times a decisive component in resolving the basic problems facing the nation, country and state.

The role and significance of research in the history of Poland's military service arises, in general, from these considerations, especially research on our armed forces in the history of our nation. This indicates a need for joint efforts in this area by the military, civilian and scientific communities.

The history of the army and the history of the nation are inseparable. Neither can the history of military service be separated from that which linked the history of the nation in every epoch of our historical process, and, conversely, the history of our nation cannot be accurately studied without taking defense problems into account. An evaluation of the causative factors which during the last war led to our national and social liberation shows to what degree the question of the nation's defense is linked with our historical process and with good social, economic and political conditions.

We have not assumed that the section's deliberations will resolve all problems or will provide answers to the questions vexing us. Instead, we believe that in participating, one relates to the theses contained in the plenary papers and will present one's own suggestions concerning the questions based on one's research work.

The substantive and cognitive value of the presentations as well as the pronouncements included in the official record require that the section's material be published and that it be made quickly available to military and civilian readers. This is recognized by all the participants in the section's deliberations. I will submit this postulate at the plenary meeting as a suggestion of the participants of Section I.

In concluding my short summation, I would like to thank sincerely all the participants in the deliberations of our section, who through their presence and active participation enriched its contents greatly.

I especially wish to thank the authors of the communiques and the speakers for their contributions, which assured the success of our deliberations. I wish to thank sincerely the representatives of the civilian scientific centers and institutions who participated in the section's work, who wanted to participate in our section's work and who support the military historian through their creative ideas and who dedicate part of their labors to defense affairs.

The section's deliberations are additional proof that the cooperation between civilian and military historical centers, which has worked well for many years, generate, in addition to satisfaction, concrete scientific research results. Proof of these results is the latest issue of DZIEJE NAJNOWSZE, which includes the research results of the PAN Institute of History and the Military Historical Institute, which in itself is strongly associated with the deliberations of our section because it contains material from a joint conference whose theme was "The Army and Society in the Latest History of Poland."

I also wish to thank the employees of the scientific institutes, the individually invited guests and all those whose contributions assured the proper progress of our section's deliberations.

Janusz Letkowski

The account outlined forthwith from the discussion, whose signal motto was the theme "The Sociopolitical Role of the Army in the Life of the Country and the Nation," for obvious reasons cannot reflect the entire wealth of the problem considered in the discussions. Undoubtedly, we will return to it many times. Thus, it also can be stated that it will be a general outline of a concise and informational nature. It would be an injustice if at the start I did not emphasize the basic role of both authors of the papers: Professors Mieczyslaw Michalik and Kazimierz Doktor. It is their efforts and labors that allow us to attempt in the discussion to define precisely problems that are of a basic, socioideological nature.

Eight speakers participated in the discussions. In order of their appearance, they are Col Prof Jerzy Muszynski, Prof Jozef Pajestka, Col Dr Zdzislaw Kosyrz, Prof Janusz Reykowski, Gen Albin Zyto, Col Prof Stanislaw Sokolowski, Prof Mariusz Gulczynski and Col Prof Waclaw Stankiewicz.

In addition, numerous pronouncements were included in the official record. All of them will be published. Their authors will have to forgive me for not naming them in turn.

As the starting point of our discussion as well as its primary idea, I would like to recall the beautiful thought written once upon a time by Col Zbigniew Zaluski: "The fate and sentiment of no other nation are as closely linked with its army as the fate and sentiment of the Polish nation." Thus, the discussion emphasized the special attention paid on the one hand to the themes of patriotism, defense and stability of the country as a category that is associated with the army in a very natural way in the minds of the public, and on the other hand as a prerequisite for integrating elements that historically shape the value system, stabilize and strengthen a sense of national identity. Also discussed were the sense of socialist statehood and the essential strengths of a modern state: party, economy, organs and army. Attention was focused on how, to a significant degree, a state functions well as an entity depending on the ideological consciousness, patriotism, deliberation, political farsightedness and internal discipline of its citizens. These values and principles of operation can be shaped and developed on the basis of the nation's socialist and patriotic culture in which, to a very important extent, the army is an integral, dialectically cohesive and functionally linked category. The problem of the role of the army as an area for breaking mental barriers on the road toward modernity, developing habits of loyalty and discipline, which then becomes an indispensable source of law and loyalty to the state, was also examined closely during the discussions. Among others, this very important area of knowledge and military pedagogy plays an important role in this area. Much time was devoted in the discussion to ideological upbringing, moral attitudes, lifestyles and life aspirations, especially of the younger generation. From this it can be seen how significant this is today.

The ideological and moral continuity of the development of the Polish state in its history was emphasized in the discussion, especially in the patriotic-democratic framework of the trend of its scientific, cultural and ethical achievements. There are many examples in Polish history of outstanding leaders and officers who were concerned not only with military problems but also with social, independence, educational and scientific problems. This activity has always been an important element of national education and for shaping the national culture. Thus, today a primary problem that Gen Wojciech Jaruzelski always refers to in his speeches is the creation of social customs and examples of patriotism, ambition, diligence, order, dedicating oneself to the primary interests of the state that are strengthened by a sense of individual responsibility of a unit for its local public affairs.

The army's place in the mechanism of the government and in the structure of the state was also discussed. It was stated that the army is an integral part of the state; it has its indispensable place in the state apparatus as a special cell in the governing structure, occupying this place by the will and command of the socialist state and nation. It also was emphasized that the Polish Army is naturally involved, socialist and class-conscious and is an integral part of the socialist system. In the frameworks of such designated state structures, there is a direct link between the state's entire economy and the army because the state of the country's economy must influence directly the state's ability in the area of defense. The example of the debt trap was noted, a debt that was brought about by underestimating the discrepancy between lifestyle, cultural style and economic possibilities, by underestimating the force of monopoly in modern technology, by not understanding world monetary-institutional processes. This was acknowledged to be an error in knowledge and policy. It was mentioned that in the present situation one can speak of an economic war between the systems that places such a branch of knowledge as the defense of the economy in a new light.

The direct participation of the army in the administration of the country during the crisis period was mentioned in the discussion. This participation was also of a methodological nature. The solutions in the area of managing and directing the economy that considered, among other things, the methodology of economic defense proved to be successful during the crisis period and created the foundations for gradually returning the functioning of the economy to normal. Also, solutions that were known and verified by the army were applied in the processes of administering the state. Here one can name the methodology of inspection and verification, the principles of cadre policy and the principles of professional ethics in administration, which are now being applied widely in the functioning of the Polish system of civil administration by means of positive legislation and political documents. What is more, scientific centers in Hungary and the Soviet Union, where optimizing the effectiveness of state functionaries is also being considered, have voiced interest via the PAN in this methodology.

Particular attention was paid to strengthening army services for all of Polish science. The army's scientific work is very valuable on a national scale.

The army has 17 scientific institutes, 11 higher officer schools and 4 academic-type schools. It was emphasized--and I consider this to be especially important--that science in Poland is indivisible, that the horizons of human thought do not depend on the color of the uniform worn by the scholar, that applying practical solutions realized in military scientific institutions has brought immense material benefits to the country and has augmented the people's knowledge, including knowledge in the exact sciences and the social sciences. In all probability, the unity of the army with society and the view concerning unity and overall identity of such concepts as honor, honesty, patriotism, duty and discipline can best direct the basic trend of our discussion.

Wieslaw Wojciechowski

I wish to inform you that over 100 representatives of civilian and military scientific centers, representing numerous groups of scholars cooperating in the area of shaping scientific and technical progress in the country, took part in today's ceremonial session of the technical section's deliberations that ended a short time ago.

The limited time for deliberations permitted only five PAN representatives and six army representatives to participate in the discussion. The remaining commentaries will be included in the official record.

We are pleased that the section's deliberations included many constructive suggestions, despite the ceremonies associated with the 40th anniversary of the LWP. Strengthening existing cooperation was mentioned most often by the speakers. The fruits of this cooperation were discussed. However, most attention during the discussion was focused on the problem of creating and expanding those methods of cooperation that would permit the amassed knowledge to be used rationally and our know-how and material potential to strengthen the country's defense.

Statements on conditions for the development of military technology, the contribution of the intellectual and economic potential for defense modernization, and the involvement of civilian scientific centers and outstanding Polish specialists to develop the state's defense dominated the discussion. The stimulative role of the army in all areas of the economy and in many scientific areas and disciplines were indicated. The army's influence in developing Polish science and its inspirational role in shaping scientific and technological progress were emphasized. It was also emphasized many times that the army has transformed itself from a "consumer" to a significant partner.

The achievements of the WAT [Military Technical Academy], the Higher Naval School and the military scientific development technical institutions that were presented by the representatives of these institutions is proof of their significant participation in the development of science and technology. Many of their achievements have won the highest scientific awards.

It was emphasized that the army's scientific research institutions are entering the area of basic research with increasing boldness, even though their main task is to conduct work of a practical nature. It is actually in this area that a special need is envisioned to expand further cooperation.

The pronouncements of the representatives of the civilian institutions indicate that PAN's scientific centers and institutions have the potential to conduct and realize basic research that is being used extensively in applied research and development work conducted by the army's scientific research institutes.

The discussions indicated that the cooperation is especially effective in cases where both sides, civilian and military, are interested in verifying theoretical and experimental scientific achievements and adapting some of their results to military technology.

It was emphasized many times that combining the efforts of civilian and military institutions permits the more rational use of their scientific potential and material base, especially unique scientific and measuring equipment.

The studies, expertise, scientific consultations and training activities resulting from this cooperation were utilized most often by the army. But for the PAN institutions, the cooperation provides special benefits vis-a-vis the possibility of "materializing" cognitive investigations because defense problems are and always have been an excellent area for the practical application of knowledge.

The army's needs for new material having specific characteristics, for new design and technical solutions, and for the rational management of space create great realization possibilities for all scientific centers.

Our own experiences and those of the rest of the world indicate that there is always a strong linkage and interdependence between the development of science and technology, and the economy and defense. Thus, as was emphasized by the representatives of the Defense Industry Committee, greater participation by the authority of science is needed to resolve specific technical problems in industry. It is anticipated that this participation will certainly reduce the existing design-technological gap between Poland's and the world's technical achievements. The efforts designed to make our machine and chemical industries independent of costly and often unjustified imports from the Western countries is of vital significance in this area.

The belief that PAN's extensive creative potential can still be used even more effectively for the defense of the country was dominant in the speeches by the representatives of PAN. It was stated that to this end it is necessary to tackle jointly problems that are of great importance to the army.

The discussions verified the legitimacy of the existing forms of cooperation based on the understandings between PAN's departments III and IV and the army's Main Inspectorate for Technology.

In activating and expanding the forms of cooperation, the activities of collegiate organs and the shaping of a proper working structure for this cooperation are especially important. Practice indicates--as Professor Frackiewicz emphasized in his speech--that above all it is the initiatives of the researchers and their direct contacts and not orders and assignments that can really produce measurable results.

It is a pleasure to report that many sincere, amicable contacts have been made, thanks to the activists for cooperation of the scientific centers. In many cases civilian and military laboratories are united permanently, producing significant reciprocal benefits.

In conclusion, I wish to emphasize that in seeking ways to implement joint, more effective resolutions of problems and the better materialization of scientific achievements, the technical section's deliberations assumed a working nature.

The suggestions made during the discussion will certainly be used in future cooperation between the technology section of the Polish Army and the PAN.

Miroslaw Mossakowski

The deliberations of Section IV concerning biomedical and food problems were symposium-like. Twelve reports and papers were presented during the deliberations, which portrayed the state of research or activity in selected areas of the medical, biological and agricultural sciences, representing either the product of scientific cooperation between the PAN and the MON institutions, or the subject of their common research and practical interests, or a complementary example that is closely related to the resolution of related scientific problems. These deliberations, which by the nature of things concern a wide segment of the set of biomedical problems, once again demonstrated the cohesion of meritorious connections, cognitive as well as practical, that link military and civilian research centers and communities in extensive areas of biology and medicine. What is more, the deliberations are further proof of the unity of the medical sciences, regardless of where they are developed or where the laboratory is located. The deliberations are an affirmation of the daily practice of cooperation between civilian and military scientific centers and research institutes. This cooperation is expressed not only in the very important and useful participation of military scientific institutions in national research programs that are coordinated by the PAN, which was discussed this morning, and in the active participation of our colleagues in uniform in the activities of the scientific committees and scientific councils of PAN's institutions, but also--and above all--in jointly participating in enriching medical knowledge and know-how. If the motto of today's deliberations is "Science in the Defense of the Country," implying the significance and contribution of scientific research in building the country's defense potential, then the course of our section's deliberations permit at the same time the addition of the slogan "The Defense of the Country for Science," reflecting the contribution of military research centers to science. And just as it was shown a long time ago in practice, so even today both sides are simultaneously givers and takers, and MON's medical institutions are a permanent and essential component of the medical-science picture in Poland.

Prof T. Bielicki of the PAN Department of Anthropology delivered the opening talk of the deliberations. His talk was devoted to the anthropological structure of the Polish population. He revealed the differentiation and stratification as well as the biological and social conditioning of this population, at the same time demonstrating convincingly the evolution of the social stratification of the Polish population over a period exceeding 50 years, which is reflected in its anthropological picture. This paper, which presented research results that are of basic scientific and

practical significance for the national economy, including the army, also shows that in obtaining these results, it was important and indispensable to cooperate closely not so much with researchers from the military institutions but with the army itself. This cooperation, which was initiated in the 1920's by Professor Mydlarski, took on new and more effective and more extensive forms in the postwar period.

The physiological basis for man's capacity for physical exertion was the most extensively discussed subject. After all, this is a problem of basic significance for modern medicine in general and its specialized branches, such as military medicine. Despite the opinions repeated here and there, even among the professional communities, the high proficiency of an organism's adaption mechanisms for physical exertion continue to be--even in highly industrialized countries--one of the factors deciding the ability of man to perform various types of work, including work related to military service and its overall vital activity. This also pertains to those forms of activity that are associated with intellectual work and excessive neuropsychotic strains that apply to all age groups.

For obvious reasons, this is of basic significance, especially in the most technically oriented army services. A general introduction to this subject was the paper by Professor Kozlowski of the PAN Center for Experimental and Clinical Medicine. This paper, which was included in the official record and is based on research conducted by a group directed by him, describes the basic mechanisms for adapting to exertion, its biochemical, humoral and neurophysiological conditions and the physiological methods for controlling these processes. The next cycle of papers, which came from the Military Institute of Hygiene and Epidemiology, expanded on this problem and provided many details. Prof J. Faff's paper described the effect of selected factors of military service on the physical efficiency of an organism that depended on the type of military service. Docent Wojtkowiak's report, which expanded this same theme relative to the extreme environmental conditions created by the acceleration to which crews of modern fighter planes are subject, described the types and mechanisms of constitutional momeostasis disorders caused by these factors. The speaker also presented means for combating and preventing them. The paper by Prof S. Baranski, Doc Z. Sarol and Dr F. Skibniewski, which concluded that portion of the deliberations, presented the methods and equipment that are used to evaluate objectively the functional status of a human organism subject to the extreme conditions of acceleration, overload and weightlessness. Worthy of special attention is the "polygraph" for physiological investigations of the human organism, which is based on the use of medical, biological and technical ideas as well as on applied mathematics. This "polygraph" has been used frequently in practice with complete success. If in the introduction to my speech I spoke about the complementarity of research, then the cycle of reports I described earlier is the best illustration of this. The same complementarity was demonstrated by the papers dedicated to the problem of an organism's immunity, which is the primary mechanism for protection in infection processes. In his paper, Prof T. Tchorzewski of the Military Academy of Medicine in Lodz described the problem of regulating the function of granulocytes in health and in sickness and the factors controlling

the activity of this population of blood cells, which is an organism's first line of defense. This paper was supplemented by the paper of Professor Gieldanowski of the PAN Institute of Immunology and Experimental Therapy, who presented the results of research conducted at his parent institute on the factors affecting a system's immunological response, in the sense of activating and strengthening the system. To me, emphasizing the value of this problem seems to be redundant.

A range of neuropharmaceutical and psychopharmaceutical investigations that were realized through the close cooperation of civilian and military research institutions were presented in the papers by Prof E. Przegalinski of the PAN Institute of Pharmacology and Prof S. Rump of the Military Institute of Hygiene and Epidemiology. The first paper concentrated on the action mechanisms of antidepression drugs that were investigated and defined at the speaker's parent institution. The second paper concentrated on the methods of treating convulsions resulting from certain chemical toxins. The research presented in the first paper, which above all was accomplished cognitively, is of basic significance in the treatment of certain mental disorders. The results of the second paper, which were presented in a practical manner, explained a number of basic mechanisms of the effect of the analyzed chemical substances on the central nervous system.

The paper by Prof T. Domzal, A. Szczudlik and J. Kwasucki of the WAM Graduate Training School occupies a special place among the reports presented in the framework of our section. This paper is dedicated to problems which a short time ago became the object of intense study and research, an area in which the scientific institution directed by Prof T. Domzal has a leading place in the country. The problem concerns the neurophysiological and neurochemical basis for pain and stress and the mechanisms to treat them pathogenetically. Once again, the significance of this research for medicine needs no comment.

The papers by Prof S. Berger, chairman of the PAN Committee on Human Nutrition, and Prof A. Rutkowski, chairman of the PAN Committee on Food Chemistry and Technology, discussed the problem of rational feeding as one of the factors determining the proper development of man and his health, and the proper production of food to protect its nutritional values and to protect it against damage. Both papers were directed basically by the army's needs and reflected the joint activities of both committees with military research institutions, especially the Military Scientific Research Center for Food Service.

In my opinion, it is a good thing that the celebrations of the 40th anniversary of the LWP created an opportunity for the representatives of the civilian and military biomedical and food sciences to meet. These meetings provided a platform to exchange experiences, ideas and viewpoints. I believe that they will bear fruit in that cooperation will expand. New research concepts and problem solutions can arise from these meetings, and the sciences and activities represented by us will benefit because, after all, all of us--civilians and colleagues in military uniform--serve one goal: the health of man, which is defined in the Declaration of the World Health Federation not as an absence of sickness but as the perceptible physical and mental well-being of man.

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TECHNOLOGY TRANSFER TO THIRD WORLD COUNTRIES DESCRIBED

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[Article by Boguslaw Jasinski: "Transfer of Technology in the Relations Between North and South"]

[Excerpts] Introduction

The importance of modern technology and equipment in the development of the world economy today can hardly be overestimated. This is one of the basic, and in some sectors the basic, factor determining the economic development. It is no wonder, therefore, that the economic sectors that in the future will determine the rate of changes in the economy and in development include new energy sources, informatics, electronics, biochemistry, genetic engineering, etc., that is, the areas of human activity which require the most investment of science and technology. It is for that reason that these spheres of activity are emphasized as the driving force behind the future economic progress in the world.

In current conditions, characterized by extremely varied development levels of economies in the world, transfer of the existing technological knowledge and know-how becomes extremely important, especially in the direction that will ensure that this information will act as an incentive in the economic development of, particularly, the Third World nations.

We know from experience that without the use of modern and efficient tools of production, a developed technology and a rational and modern economic infrastructure, one can hardly speak of accelerating the economic progress of the developing nations. Using the existing technologies and all the economic activities associated with them can be of a major significance in stepping up the economic development of Third World countries. The awareness of this fact has moved the international community to various steps in the international sphere for creation of an effective mechanism to utilize the existing technologies and know-how in the advancement of economically less developed countries. Among the various undertakings in that area, one can mention the Declaration on the Establishment of a New Economic Order (May 1, 1974), the UN Resolution (Dec 12, 1974): The Charter of Economic Rights and Responsibilities of Nations, and the Lima Declaration (1975): The Program of Action on Industrial Development and Cooperation (approved by the Seventh Special

Assembly of the United Nations in 1975) and also numerous meetings of Group 75 at the ministerial level, particularly in 1971, concerned, among other things, with this group of problems.

The concept of appropriate technology as an economic category is conceived as the use by a given nation of such production and technological solutions that are optimal for the development of a particular branch of industry and the economy as a whole. This involves not only the choice between the old and new productive technologies but also the favorable possibility in terms of a macroeconomic approach for substituting the production factors to allow utilization of those which are available in relatively excessive amounts. As a result, the application of proper technologies should be defined in terms of optimization not only on the micro- but on the macroscale as well. On the other hand, proper technology should not be viewed statically, but rather dynamically, that is to say, practical application of individual technological processes should take into account the possible modifications and improvements coming in the future.

Forms of Transfer of Technology From Socialist Nations

The level of economic links between socialist and developing nations continues to be relatively low. Among other things, this is a consequence of the fact that the socialist nations have not initiated their socioeconomic contacts with the Third World countries before the late 1950's. It should be indicated, however, that, apart from a few exceptions, socialist nations have themselves been in the group of less-developed countries before World War II which had no colonial tradition and thus had no traditional links with the developing nations either in markets or in production or in technological solutions, which remains the privilege of developed capitalist nations. One should not be surprised, therefore, that the position of socialist nations compared with that of developed capitalist countries is still weak on the markets of the developing nations. The lower competitiveness of the former group of nations, however, is currently offset not only by political factors but by such factors as experience with accelerated economic growth, the level of technology that can be alternative compared to some of the technologies of developed capitalist countries, a relatively free access to this technology, stability of economic links, etc. These are significant factors in view of the difficulties confronting currently the developing nations in the process of their industrialization.

The scope of economic links between the socialist nations and Third World countries is expressed in the scope and directions of its technology transfer. According to estimates,[17] taking the transfer of technology from south to the north for 100 percent, about 85 percent of this flow originates from developed capitalist nations, about 10 percent from European socialist nations, with the remaining 5 percent being transfer among the nations of the south. It can readily be seen that these proportions are similar to the figures of imports of developing nations from these three major sources of the world economy (mainly as regards imports of producer goods).

The differences in the nature and scope of economic links between the socialist and developing nations also result in certain variations of technology transfer as compared with the capitalist nations. These differences have both historical and systemic reasons. For example, in the transfer of technology from Western nations, the predominant forms are direct investment and joint ventures, whereas in the transfer originating from socialist countries, direct trade and sale of services on mutually beneficial terms are the predominant forms, with an increase in the industrial cooperation over the past decade. Socialist nations do not engage in direct investment the way it is done by international corporations, and the bi- and trilateral joint ventures (with participiation of a firm from a developing nation and Western firms) as yet do not contribute any major share to technology transfer.

Generally, socialist countries implementing the principle of partnership and mutual benefit in technology transfer propose solutions which correspond to the technological and industrial conditions of the given nation and are favorable in terms of overall economic development. This involves substantial assistance with adjustment of technology, equipment and organization of industrial production to local conditions, which is mainly provided free of charge.

Until now, several channels of flow of technology from socialist nations to developing nations have been established. These are:

a) export of producer goods and complete industrial objects;

b) export of technological services;

c) employment of specialists in developing nations (both through international organizations of the UN system and through governments of the socialist countries and individual companies);

d) education of professionals from developing nations; and

e) setting up combined production and trade enterprises in the developing nations, with the participation of firms from socialist countries.[18]

Until now, the first three channels have been of greatest significance. Vocational education is certainly an effective form of transfer, but it takes time (from 5 to 15 years) until it produces the results as regards both technology transfer and domestic technological development in the long run.

Special publications in the field frequently mention a low competitiveness of technology from socialist nations compared with that from developed capitalist countries. Basically, this is a misunderstanding. There is no questioning the fact that in engineering, chemical or food industries the capacity for absorption of technological solutions originating from socialist countries is greater than for those coming from capitalist nations, if they are considered in terms of optimal utilization of the basic productive factors. As it stands, the problem, however, lies with inadequate utilization of the carriers of this technology in the economic relations with the developing countries. Barriers to faster transfer of technology from socialist to developing countries are limited productive capacities (mainly in producer

goods) of socialist countries, a limited credit capacity and the resultant difficulties in adjusting to variable market requirements, as well as insufficient aggressiveness in penetrating the markets of the developing nations.[19] The same limitations which restrain the commodity exchange between these groups of nations and the expansion of reciprocal economic relations are observed equally in technology transfer.

In the economic relations between socialist and developing nations, it is difficult to isolate any branch of the economy or industry that deserves preferential treatment in terms of technology transfer. This activity embraces all sectors of the economy (industry, agriculture and services), even though (considering the size of exports to developing nations) producer goods are predominant for development of industrial enterprises. In the last decade, more than half of the exports to developing nations consisted of products of machine-building and engineering industry, as well as transportation vehicles.[20]

Since a certain proportion of industrial goods being exported are not carriers of transferred technology or know-how, the dimension of technology transfer can be estimated only approximately in terms of the volume of industrial exports from socialist to developing countries.

The participation of the Third World nations in the global export of industrial articles from socialist countries (according to SITC classification,commodity groups 5 through 8) amounted to 13.3 percent in 1970 and 12.4 percent in 1976. Overall, it was greater than the share of developing nations in global exports of the socialist countries. If the structure of exports from socialist nations to this group of countries is considered in physical terms, the exports of industrial articles under the above-mentioned groups was in 1970 51.6 percent of the total export and in 1976 47.7 percent. These quantities do not include exports of iron, steel and nonferrous metals.

In value terms, the exports have grown (as SITC groups 6 and 8) from an amount of $540 million in 1970 to as much as $1,360 million in 1976. The exports of machinery and transportation vehicles (SITC group 7) in that period grew from $2,400 to $5,230.[21]

According to some studies,[22] the European socialist nations until 1978 have constructed (including the uncompleted projects) about 4,000 industrial enterprises, including 180 engineering and metal works, 50 steel and nonferrous metal furnaces and over 500 factories in light and food industries.

An important role in transfer of technology is played by international agreements on industrial cooperation which are implemented by individual enterprises from the two groups of nations. Generally, these are simple forms of cooperation in the production sphere which greatly facilitate the transfer of technology. They include, for instance, reciprocal supply of components and subassemblies and other productive and technological elements in exchange for finished goods, compensation agreeements and production contracts (constracts for manufacturing of products in exchange for supply of raw materials based on established technologies).

As regards creation of joint projects, the cooperation between socialist and developing nations is still in the early stages. Until 1978, there had been 100 such joint enterprises with participation of capital from socialist countries, including 20 engineering and metal industries, 14 in construction and 12 in mining.[23] Participation of socialist countries is relatively limited, never exceeding 49 percent of the capital. In physical terms, this participation includes supply of equipment and machinery, as well as technological know-how and special services. The joint ventures are too small and as yet do not play a substantial part in the nations where they operate.

It seems that joint ventures of this kind could play in the future an important role in the technology transfer if they become more widespread, because their structural and operational principles provide more favorable conditions for technology transfer than joint ventures with companies from developed capitalist countries.

The basic channel of transfer of technology from socialist countries to developing nations at this point remains the export of producer goods, as well as construction of turnkey industrial projects and export of technological services, combined with professional training and services. A much lesser role belongs to cooperative agreements or joint ventures, despite the fact that the latter two channels of technology transfer seem to be relatively more effective.

FOOTNOTES

17. LE MONDE,16 Aug 1983.

18. "Eksport techniki do krajow rozwijajacych sie" [Export of technology to developing nations], Warsaw, 1976.

19. C.T. Checinski, "Conditions for intensifying exports of scientific and technological results and services to Third World nations," HANDEL ZAGRANICZNY, No 12, 1979.

20. It is incorrect to interpret all products of machine engineering and metal industries as "vehicles" of technology transfer. Some of these are durable consumer goods or metal castings, metal products, cables, etc., which virtually do not contribute to transfer of technology and technological knowledge.

21. "Handbook of international trade and development statistics," New York, 1979, pp. 115, 758, 770.

22. G.M. Prokhorov, "Productive cooperation of CEMA member nations with developing countries," VOPROSY EKONOMIKI, No 11, 1979.

23. Ibid.

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POLAND

APPLICATION OF COMPUTERS IN STATISTICS DESCRIBED

Warsaw WIADOMOSCI STATYSTYCZNE in Polish No 7, Jul 84 pp 10-15

[Article by Professor Tadeusz Walczak, DSc, Chief Statistical Office: "A Look at Applications of Information Science in Statistics as an Overview Towards the 40th Anniversary of People's Poland"]

[Excerpt] Current State and Problems of Development in the Near Future

Despite what one may think at first glance, an evaluation of the current status of information science applications in statistics is neither an easy nor simple task.

On the one hand, a definite achievement that deserves emphasizing in connection with the 40th national anniversary is the fact that despite difficulties and problems it has coped with the tasks imposed on it by statistics, especially in such areas as processing the data of the general census and other large-scale surveys. Information scientists, in a joint effort with statisticians, have passed well the difficult test and managed to process the increased flow of data after changes of the reporting principles in 1982 without any major stoppages. Information science and computers are providing substantial assistance in the processing of current data at the Warsaw Statistical Office [WUS]. A major achievement of information scientists was also modernization of data-processing technology and methods, as has been mentioned previously.

Owing to the applications of modern information technologies in a number of areas, especially in industry and construction, innovative projects have been introduced which involve integration of data originating from various material and financial reports and embracing the current information on output, employment, producer goods, financial results, etc. This made it possible to develop new groupings of data, compute a series of new current indicators and provide a more comprehensive representation of the conditions and results of activity of enterprises.

Several years ago, data originating from various reports began to be integrated into what is known as data banks, which I believe to be a major tool for improving the quality of information and a precondition for development and deepening

of statistical economic analyses.

Without applications of computerization, it would be extremely difficult (if at all possible) to compute statistical price indices concerning market commodities and prices of materials and producer goods, construction operations, etc., which are important for all statistical studies.

Computerization made it possible to calculate demographic forecasts and apply the method of factor analysis and other mathematical techniques.

On the other hand, information science applications are the target of justified criticism and dissatisfaction with the existing situation.

Criticism from statisticians is understandable, especially in view of the fact that huge new assignments faced by statistics in 1981-82 had to be handled without any additional employment of personnel. All additional, although limited, fund allocations which were received were channeled into development of information science and computerization, mainly to strengthen the groups concerned with data preparation and control.

The criticism addressed to information scientists includes the following items:

1. Excessively long time of processing of many the items important for statistics. This concerns both projects that are essential for analysis, studies and publications prepared by WUS and the Chief Statistical Office [GUS], as well as those provided for other agencies. Belated supply of data for administrative agencies (ministries and province governments) often causes these agencies to collect data from their subordinate enterprises, thus creating the danger of deflections in the even flow of information, especially in view of the changes introduced in accordance with the principles of the economic reform.

2. Major difficulties in meeting the time schedule in preparing the computer programs necessary for performance of supplementary and additional assignments. The number of these tasks has increased in recent times because of the need for observing the results of activities of enterprises as a function of changed parameters embodied in the principles of the economic reform.

The growth of difficulties at the phase of software development, especially since early 1984, was, among other things, affected by the introduction of a large number of changes in the operating electronic data processing systems, especially the increased demand for supplementary data and analysis that cannot be managed given the existing capabilities of engineers and programmers. This was aggravated by serious difficulties in ensuring stable employment for engineers and programmers. In 1983-84, despite the increase of assignments in system design and programming, the employment in these professional groups contracted because of difficulties in keeping the staff.

Currently, the government statistical agencies have 11 electronic data processing centers equipped with computers and subordinated to ZMiAOS and 28 information centers using minicomputers. These centers make up part of the provincial statistical offices.

In 11 provinces (Biala Podlaska, Chelm, Gorzow, Wielkopolska, Leszno, Lomza, Piotrkow Trybunalski, Plock, Suwalki, Tarnobrzeg, Torun and Zamosc), there is a shortage of even the most modest technological facilities. This creates obstacles to observing unified schedules for data processing by all provinces and presents difficulties in consistent implementation of decentralized data processing. The plans for information science and computer applications development in statistics for the coming years therefore envisage supply of appropriate facilities to these provinces as one of the major goals.

Generally, by the end of April 1984 the GUS electronic processing centers had 20 operational computers. In the near future, after the Odra computer is put into operation at Olsztyn and two ME computers are installed at the electronic center at Warsaw, the number of computers working in statistical offices will reach 23.

The number of minicomputers operated for information centers of the WUS is 62, including 10 Cellatron minicomputers, 19 Mera 306's, 6 Logabaks and 27 Mera 9150's. More than 25 Mera 9150's (and other equipment manufactured by Redifon) operate at electronic data processing centers as data registration devices. Two Mera 9150 units control remote printers in TELZIS data transmission systems.

Due to shortages of investment funds in the last few years, many computers are fairly advanced in their service life, and a large part of them have to be replaced. Out of 20 computers operational at GUS centers, 17 have been working for seven years and longer. In view of the fact that most of these computers have been in intensive three-shift operation, they should gradually be phased out. However, given the current situation and the actual possibilities, there are plans to prolong their service life and furnish them with additional equipment.

As regards minicomputers, old types of machines--Cellatron--are being gradually pulled out of operation; next to go will be Mera 306 units. Instead, Mera 9150's will be installed. Efforts are being made to equip the latter with line printers that will improve their efficacy in producing WUS reporting tables.

Developing a realistic program of information science development for the coming years is extremely difficult today because of a shortage of reliable data as to the plans of domestic production of computer equipment.

For a long time, there has been talk about discontinuing the Odra 1300 computers. The prospects of domestic manufacturing of computers for the Uniform System are unclear, and any conclusions based on the existing experience as regards the purchase of these machines should be cautious. And yet,

since an early preparation for a major renovation of the computer fleet is extremely important for normal functioning and development of Polish statistical activities, in particular, in view of the general census that will be conducted in a few years, preparing a program of development of computerization in statistics in 1990 is urgent. The major components of this program should include provisions for:

1. Unification of the equipment at provincial statistical offices using modernized versions of the Mera 9150 computers, which must be equipped with efficient printers. It is important to increase the working memory capacity and provide disk memories of large capacity and high operational reliability. In modernizing this equipment, an efficient, flexible and simple programming system should be maintained.

2. Based on modernized 9150 Mera systems, a decentralized procedure for data processing should be introduced consistently, based on local preparation of data vehicles in each province and adequate control of data, and preparation of the necessary final tables for the provinces. This should be accompanied by simultaneous generation of a copy of machine data carrier with reporting data to be channeled to GUS for compilation of the appropriate tabulations.

3. The maximum possible reduction of the time for organizing the computerized data processing centers in provinces which still have no such facilities. Before such centers are organized, however, alternative intermediate forms of modernization of data processing techniques should be sought, such as installing operator terminals linked to Mera 1950 units in neighboring provinces through data transmission lines, use of microcomputers, allowing at least elementary control and recording of data on magnetic media.

4. Modernization of the configuration of the Odra 1305 computer by replacing the obsolete ferrite core memory with modern high-capacity memory, increasing the capacity of disk memory and introduction of advanced operation systems. Given favorable conditions, efforts should be initiated to replace some of the older Odra machines with modern brands before 1988, that is, the time preceding the general census planned for the end of 1988.

5. An element of the plan for development of information science applications in statistics should be program of organizational and technical improvements that would include a set of measures ensuring improvement of organizational work in view of the expanded participation of province levels in these activities. As part of organizational improvement, more attention should be given to streamlining programming operations and fuller utilization of the results of control to improve the reliability and quality of reports.

Modifying the general attitude toward information science applications and computers in statistical work should also be considered. All over the world, information users tend to have direct access to computer technology as a convenient tool for data processing and analysis. This attitude gave rise to the concept of so-called personal computers, which is used on a growing

scale, regardless of the development of information facilities used by professional analysts. Attempts at direct use of computers for control of reports and preparation of final data by statisticians themselves through direct access to computers are already practiced in some socialist countries. This may be a key to solution of some of the current problems.

Table 1. Estimated Labor Costs Involved in the Census of Population and Households in 1970 and 1978

	1970		1978	
Type of activity	Thousand hours	%	Thousand hours	%
Total	5556	100.0	8440	100.0
including:				
Obtaining responses and registering data in census forms	2750	49.5	6060	71.8
Receiving and sorting forms	68	1.2	279	3.3
Encoding (with symbols)	1693	30.5	1320	15.7
Chart printing and verification	625	11.2	-	-
Data registration on magnetic media	-	-	452	5.4
Automatic form reading	-	-	5	0.0
Analysis and correction of errors	294	5.3	97	1.1
Computerized processing	16	0.3	96	1.1
Compilation of final tables for printing	110	2.0	131	1.6

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PROBLEMS, SHORTCOMINGS IN BIOTECHNOLOGY DESCRIBED

Warsaw PRZEGLAD TECHNICZY in Polish No 34, 19 Aug 84 pp 10-11

[Interview with Professor Maciej Wiewiorowski, full member of the Polish Academy of Sciences (PAN), head of the Institute of Bioorganic Chemistry of the PAN and chairman of the 14th International Symposium on Natural Products Chemistry (IUPAC), by Daniela Baszkiewicz]

[Excerpt] [Question] What exactly is modern biotechnology and which of its accomplishments do you consider truly epochal? Will they permit us to conclude that the world has achieved that long-awaited revolution in biological sciences?

[Answer] Although I do not consider myself an expert in the field of biotechnology, for I consider that a biotechnologist is one who deals with industrial technology, I will attempt to answer your question. Modern biotechnology, in contrast to classical biotechnology--and in this latter group I include those branches of biotechnology in which natural products are isolated on an industrial scale or are at times manufactured, modified, or refined (I am thinking here, for example, about cellulose, sugar, aromatic oils produced by the pharmaceutical industry)--is that which, in a much more sophisticated fashion, obtains natural products, sometimes on the basis of the newest methods of molecular biology, of molecular genetics, or of the techniques of genetic engineering. This has been accomplished today, for example, on the basis of newly isolated substances--the so-called restrictive enzymes,--as well as bacterial plasmids, or cyclic forms of DNA, which permit the introduction of new information into the genome--the genetic system of the cell. The new biological techniques include at present the new type of cell and tissue culture.

[Question] Then biotechnology in Poland today, beset by a crisis, is, in a word, a skeleton key by which we would like to open the door to the modern era.

[Answer] Not only in Poland. The view that biotechnology is the key to the modern era is prevalent throughout almost the entire world. It has become more the hobby of the journalist than of the scientist, although it is necessary to admit that even the latter are showing significant excitement over what has been going on now in the biological sciences.

[Question] Great excitement among scientists?

[Answer] After quite a long period of stagnation in the fundamental bases of molecular biology, more rapidly than they could have expected it, scientists have found themselves on a completely new path of development in the biological sciences. Moreover, the surprises which engineering produced shocked them. Thus, engineering has contributed to the fact that right before our eyes molecular biology, an apparently abstract field, is being transformed into the molecular biology of the cell, a subject which is found precisely in the mainstream. Today, molecular biology is already having an effect on fully practical or applied areas of biology--medicine, industrial microbiology, and others.

[Question] In medicine, chiefly on oncology?

[Answer] Obviously on oncology also, but I am not really concerned here with concrete branches of medicine...

Not long ago I had the opportunity to read in the NEWSWEEK an article saying that there are experts from the field of molecular genetics working even in American hospitals. I do not know whether the experiment which constitutes the introduction of molecular genetics into the hospital is a success; however, the most important thing in this whole affair is the very fact that the basic research has become a kind of public property and that it is producing wholly measurable profits. On the Polish scale, timid attempts in this direction are being made by the Institute for Human Genetics of the PAN.

... Until recently it was thought that the structure of the cell nucleus and its most essential part, chromatin, was a fortress much too difficult to be conquered by science. Now, in spite of the fact that the object itself remains a secret, it is being attacked from different directions, and so effectively that it is already possible to speak about a very solid basis for the marriage of the classical genetics of Mendel with molecular genetics.

[Question] Let us shift to the Polish situation: does our science have any kind of chance to develop basic research in the modern biological and chemical sciences, so that in favorable and no longer crises-ridden economic circumstances it would be possible to attain some civilizing success?

[Answer] I think that finally there has been a change in the manner of thinking about biological sciences in Poland. We have, for example, a great number of quite good classical biologists, and it would have been good to introduce them to the secrets of molecular biology more rapidly than they have been up to now--molecular biology is a field which, until recently, was almost repulsive to morphological biologists. Today we are in possession of several strong, ministerial centers for the biological sciences, which are very valuable, but which are not adapted to the requirements of the "new" paradigm. In my opinion, it would be necessary to unify the work of classical biologists and molecular biologists. As far as I know, the Polish Academy of Sciences would eagerly play the role of unifier.

[Question] But as yet, biologists do not even have access to expert literature.

[Answer] You have raised a very painful question. With regard to expert literature it is, in our country--and this is possibly true in a great number of fields--worse from year to year. Everywhere in the world, even in other socialist countries, everything is being done to make life easier for scientists, at least with regard to access to literature. Here, institutes devoted to this are supposed to exist, but... For the rest, I do not have words for everything that is happening in this area. This matter has been left to chance in Poland, and this simply cannot be.

Not long ago there appeared in the West a thick book by a team of authors among whom was a Nobel Prize laureate, the famous James Watson, whose article was entitled "The Molecular Biology of the Cell." Another Nobel Prize laureate, who is completely unsympathetic to Watson, wrote an enthusiastic review of the book. He stated that the appearance of this book is a more important matter even than that for which Watson received the Nobel Prize, in that it succeeded in constructing a bridge between molecular and classical biology. We, under the influence of the good potential of people in the biological sciences, ought to attempt to build such a bridge, if only through the publication of this book in our country.

I have even suggested to the competent individuals that they should make contact with the authors. Perhaps this scientific best-seller will manage to get published in Polish in a reasonable period of time. This is an imperative for today; there can be no talk now about Poland's catching up with the world in the biological sciences when such important matters as this publication are delayed by, let us say, 5 to 7 years. The affairs of this book will become an answer to the question of whether we will succeed in making even this one solitary step forward. Most of all, do not forget that it will not cost a lot.

[Question] It will cost a little, but the financial blanket of the PRL is short. There is a lack of money for everything....

[Answer] I have a different view of this matter. The money is there, it is only badly distributed. The funds which have been earmarked for progress in the biological sciences are in fact small and not comparable to those funds which have been allocated to energy, armaments, and so on.

I place great hope in the last meeting of Premier Jaruzelski and other members of the government with the leaders of PAN. It created a new climate of integration of the efforts of all the lines of science which have up to now been separated into basic and applied research.

[Question] A chance for a new climate in spite of the crisis?

[Answer] The crisis must be forced into still more reasonable and precise activity, and may in no way absolve the passivity of the scientists responsible

for the concrete sphere. For it is precisely they who must loudly demand centers for research, regardless of whether or not they believe in the effects of such behavior. Thus is affirmed for me the truth that, in our country, nothing is attained if it does not follow consistently from these postulates. A chance for progress in science, in spite of the crisis, is also created by the enthusiasm for research which still glimmers in people. I offer the following slogan: Poland will not perish as long as the enthusiasm of Poles for the continuation of research lives on the Vistula, Oder, and Warta as well as in Washington, Paris, and Tokyo.

[Question] We have touched on the problem of study trips abroad. Do all those from your department who have been invited to the West manage to go abroad?

[Answer] Until recently, I never had any problems, but at the present moment things look less optimistic. This is already an internal matter for our Academy of Sciences.

[Question] Does it make sense to talk about the private affairs of the academy when the matter concerns progress in the entire country?

[Answer] I have spoken out widely in the PAN on the theme of the newly introduced central system of qualifications and disbursement of stipends. In my opinion it is no good. There is too little room in it for confidence in the recommendation of the director of a scientific establishment concerning a trip. I do not oppose centralization if it is constructive.

[Question] Insofar as I understood it, the positive opinions of the directors are additionally reviewed by a central commission.

[Answer] I have nothing against this; however, from time to time proposals are denied without any reasons being given. In this manner the affairs are prolonged.

I would much prefer that our scientific workers spend time studying in the East and in the West. I consider the suspension of trips or making them difficult inadvisable. I myself have not personally suffered from these difficulties; on the other hand, I am familiar with cases which testify that the situation during the last 2 years has been far from satisfactory.

[Question] Scientific study trips can involve the following scenario: young people returning from abroad, though good specialists, cannot make full use of the knowledge they have acquired.

[Answer] Indeed, in Polish molecular biology and genetic engineering the scientific workshop is relatively speaking improverished, and the supply of money for equipment and chemicals was significantly cut as long ago as 1975-76. At the present moment we are, to put it simply, on our last legs. Projects for the development of the sciences have been worked out by the committees on biochemical sciences, biophysics, and molecular biology have proved to be very reasonable, but what of it when we do not have the means to bring those plans to life?

[Question] Have you broken off contact with those who are extending their terms of residence in the West?

[Answer] Fortunately, I have not broken off any contacts. Besides, almost all of them are returning home after 2-3 years. As a scientist, I sympathize with their reasons for prolonging their stay in the West.

I know, simply, what kinds of scientific facilities they have at their disposal in the West, and what kinds they have here. I will always be happy to see the most valuable individuals in my institute, however long I may remain its director.

[Question] Do you take advantage of all possible study trips for workers to the socialist countries?

[Answer] Not a single proposition which has come from the socialist countries has been wasted, in particular from the USSR and Czechoslovakia, where interesting research is being carried out.

[Question] At the 14th IUPAC Symposium you held the office of chairman. The symposium was held in Poland for the first time. Why should there be such splendor for Poznan?

[Answer] This is not splendor, but a chance which is given by the IUPAC to smaller centers. Such meetings make it possible to compare our knowledge with the knowledge of famous scientists, often Nobel laureates, and to present at a broad forum those things which are going on in our country; and really, natural products chemistry has a fine tradition in Poland.

[Question] What national centers do you consider important in the modern biological sciences, which constitute, as it were, a bridge between classical biology, chemistry, biochemistry, biology, and molecular genetics, and which are shaping the future biotechnology?

[Answer] The list of these centers is quite long, so I will name only a few: the PAN Institute of Biochemistry and Biophysics, the PAN Nencki Institute of Biology, the Institute of Genetics of the Warsaw University, the PAN Institute of Organic Chemistry, the PAN Lodz Center for Molecular and Macromolecular Research. Among the polytechnics in Gdansk and Lodz as well as at the University of Gdansk, vigorous teams which are studying peptides are active; moreover, in Warsaw, a group of scholars from the University of Warsaw are researching alkaloids and sugars. But once more I would like to emphasize that the Poznan scientific center should not be overvalued and in particular should not be placed in competition with the research being done in the rest of Poland.

[Question] But there must be something that distinguishes this center...

[Answer] Perhaps the fact that it is very unified, and has good internal communications. In conjunction with this, a pleasant atmosphere of partnership

between the representatives of the various disciplines of the biological sciences has developed. I do not know how long it will continue.

One real distinguishing characteristic for Poznan is the fact that we have the Interuniversity Institute of Biochemistry, which is unique on the national scene. It is called "interuniversity" because in it scientists from the medical and agricultural academies and from the university all work together. The duplication of the Poznan example in other cities in Poland is something which I would consider worthy of attention.

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